

**IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF OHIO
EASTERN DIVISION**

OHIO COAL ASSOCIATION, et al.,

v.

Case No. 2:14-cv-2646

THOMAS E. PEREZ, et al.,

Defendants.

and

MURRAY ENERGY CORPORATION, Case No. 2:15-cv-448
et al.,

Plaintiffs,

Judge Graham

Magistrate Judge Deavers

v.

THOMAS E. PEREZ, et al.,

Defendants.

ADMINISTRATIVE RECORD

PAGES 00466 – 00661

C. Harder Cases as Easy Ones, and VSL Again

Is there a reason to treat the harder cases as identical to the easy ones? Is this absurd?¹⁸² Agencies do not distinguish between them, although recent guidelines, encouraging agency attention to distributional issues, might eventually persuade them to do so.¹⁸³ A possible reason for treating the harder cases the same as the easy ones is the existence of an optimal income tax. If the tax system produced the right level of redistribution, there would be good reason for agencies to rely on individualized VSL and not to concern themselves with whether the beneficiaries of regulation were paying for any or all of the costs. The hard cases would be treated as the easy ones. For people who believe that the hard cases must be treated differently, it is because further redistribution is desirable.

Another reason for treating the harder cases as the easy ones would be optimism: perhaps everything will balance out in the end. Perhaps no group will be systematically helped or hurt, and the tax system will produce appropriate redistribution. In the real-world cases, regulators might also think that a direct inquiry into welfare, bypassing WTP, would be extremely difficult or perhaps even impossible to operationalize. If distributional considerations are relevant, interest-group warfare may be the consequence, rather than distribution to those who particularly need and deserve help.¹⁸⁴ More modestly, it might be concluded that agencies should generally pursue efficiency, using WTP as the foundation for decisions, but should allow distributional findings to cut the other way in cases in which there is compelling reason to do so. In fact this approach is a plausible

Legal Rules Be Used to Redistribute Income?, 70 U. CHI. L. REV. 439, 439 (2003) (“[T]he tax system is a better tool for redistribution of income than legal rules.”).

182. See John Broome, *Cost-Benefit Analysis and Population*, 29 J. LEGAL STUD. 953, 958 (2000) (urging that “there are separate reasons why preferences are an unsatisfactory basis for valuing lives,” including that, “in contexts involving risks, people’s preferences are generally muddled and incoherent” rather than rational). If preferences are in fact muddled and incoherent, current practice is of course on thin ground.

183. See OFFICE OF MGMT. & BUDGET, CIRCULAR A-4, REGULATORY ANALYSIS, at 4 (Sept. 17, 2003) (noting that “possible justifications [for regulation] include . . . removing distributional unfairness”), available at <http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf>.

184. See, e.g., Viscusi, *supra* note 10, at 844–45 (describing, as an example of interest-group warfare, how an affluent suburban neighborhood successfully thwarted the development of a nearby landfill, resulting in the landfill’s being moved to a “pristine research forest and nature preserve” belonging to Duke University because the university was located in a neighboring county and thus possessed less political clout than the suburban neighborhood).

way of reading the Office of Management and Budget's current guidelines on regulatory impact analysis.¹⁸⁵

In the easy cases, the resulting redistribution is almost certainly perverse, because forced exchanges, under the stated assumptions, are highly likely to harm the people who are being coerced. But in the harder cases, it cannot be said that the beneficiaries of regulation will be harmed if government uses a number that exceeds their actual VSLs. Everything depends on the distributional effects of the regulation. If the beneficiaries are well-off, a high VSL might produce perverse redistribution if those who lose are toward the bottom of the economic ladder. It is possible to envision this result, for example, with a pollution program that protects those who visit expensive recreational areas. In contrast, if the beneficiaries are poor, and if the costs are borne by the wealthy or by the general population, a high VSL might be in the interest of those who need help. Air pollution programs, providing special protection for people in cities, appear to be an example.¹⁸⁶ It is therefore reasonable to reject the confident view of economically inclined analysts who believe that accurate VSLs, based on actual WTP (and hence individuated), should always be the basis of regulatory policy. But it is similarly reasonable to reject the confident view of skeptics who believe that a uniform VSL, refusing to make distinctions among persons, is best on distributive grounds.

What are the implications for individuation of VSL? It remains true that according to the theory that underlies agency valuations, a higher degree of individuation would be desirable. It also remains true that with respect to risks, individuation is appropriate insofar as valuations differ depending on the nature of the risk at stake. The principal qualification is that a uniform VSL, one that gives disadvantaged people regulatory protection in excess of their WTP, might turn out to have fortunate distributional consequences in the harder cases. Regulators should be careful about this point. It will not

185. See OFFICE OF MGMT. & BUDGET, *supra* note 183, at 5:

There are justifications for regulations in addition to correcting market failures. A regulation may be appropriate when you have a clearly identified measure that can make government operate more efficiently. In addition, Congress establishes some regulatory programs to redistribute resources to select groups. Such regulations should be examined to ensure that they are both effective and cost-effective.

186. See Kahn, *supra* note 150, at 38 & tbl.3 (finding that "residents of the Los Angeles basin, where regulation is especially stringent, experienced a larger pollution exposure reduction than [other] California residents").

always hold, and if the goal is to provide more assistance to those in need, a uniform VSL is hardly the best way to achieve that goal. Consider the case of poor areas of the country: a national VSL of \$6.1 million would almost certainly be harmful, simply because the resulting levels of regulation would have adverse effects on wages and employment levels. My only point is that in some cases, individuation across persons will produce worse outcomes on distributional grounds and possibly on grounds of welfare as well.

IV. GLOBAL RISK REGULATION AND CROSS-NATIONAL VALUATIONS

The analysis thus far has significant implications for global risk regulation and cross-cultural variations in WTP and VSL. In this Part, I turn to those implications. My conclusion is that poor countries should use a lower VSL than wealthy countries, and that people in poor countries are not helped if the United States, or an international body, insists on a high one. But the analysis must be different if the question is the behavior of donors or donor nations. Nations who are most in need deserve help, even if their WTP is low. For purposes of regulation, however, insistence on a high VSL will not provide that help. I begin with the distinction between donor practices and government regulation and then turn to the practical question of cross-national valuations.

A. *Are Indian Lives Worth Less Than American Lives?*

I have suggested that people in poor nations show a lower WTP and hence VSL than people in wealthy nations.¹⁸⁷ Because poor people have less money than rich people, this finding should not be at all surprising. Building on evidence of this kind, some assessments of the effects of global warming find far higher monetized costs from deaths of people in rich countries than from deaths of people in poor countries.¹⁸⁸ These assessments have been highly controversial;

187. See *supra* Table 3.

188. See Kirsten Halsnaes et al., *Case Studies for Zimbabwe, Botswana, Mauritius and Thailand*, in CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT: PROSPECTS FOR DEVELOPING COUNTRIES 202, 206–07 (Anil Markandya & Kirsten Halsnaes, eds., 2002) (calculating a VSL for the European Union of \$3.9 million in 1995 prices, compared to VSLs of \$315,000 to \$1.2 million for the four developing countries in the case study); cf. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, THIRD ASSESSMENT REPORT: CLIMATE CHANGE 2001: MITIGATION 483 (finding that “[t]he VSL is generally lower in poor countries than in rich countries”), available at http://grida.no/climate/ipcc_tar/wg3.

Professor John Broome, for example, notes that under one approach, an American life is worth ten or twenty Indian lives, a judgment that he deems "absurd."¹⁸⁹ As a result, some analysts, including the Intergovernmental Panel on Climate Change, have opted for a worldwide VSL of \$1 million, a choice that seems quite arbitrary and potentially harmful to people in rich and poor nations alike.

The issue raises important dilemmas. How should global institutions assess the monetary value of human lives? What are the monetized costs of ten thousand worldwide deaths from global warming, deaths that include eight thousand people from poor countries and two thousand from wealthy ones? The discussion thus far suggests that there is no sensible abstract answer to these questions; it is important to know what, in particular, the answer is *for*. If a general question is asked, outside of any particular context, about the monetary value of a stated number of deaths in 2020, it is best left unanswered (except perhaps with laughter). The appropriate assessments of VSL, and variations across countries, depend on their intended use. If disparate numbers are meant to identify the actual monetary values of human lives, and to suggest that people in Canada are "worth" much more than people in Argentina or that poor people are "worth" less than rich ones, the numbers are ludicrous as well as offensive.

It is possible to go further. If the disparate numbers are meant to suggest the appropriate amount that donor institutions should spend to reduce mortality risks, they make little sense. The fact that a poor person in a poor nation would be willing to pay \$1 to eliminate a risk of 1/10,000, whereas a wealthy person in a wealthy nation would be willing to pay \$100, cannot plausibly be used to defend the view that

189. See Broome, *supra* note 182, at 957 (noting that this conclusion is a product of "a money-metric utility function to represent a person's preferences," an approach that Professor Broome rejects). In the easy cases, I suggest that a money-metric utility function is not absurd, and it is not quite absurd in the hard cases either. See INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 188, at 483:

The VSL is generally lower in poor countries than in rich countries, but it is considered unacceptable by many analysts to impose different values for a policy that has to be international in scope and decided by the international community. In these circumstances, analysts use average VSL and apply it to all countries. Of course, such a value is not what individuals would pay for the reduction in risk, but it is an "equity adjusted" value, in which greater weight is given to the WTP of lower income groups. On the basis of EU and US VSLs and a weighting system that has some broad appeal in terms of government policies towards income distribution, Eyre *et al.* (1998) estimate the average world VSL at around 1 million Euros (approximately US\$1 million at 1999 exchange rates).

an international agency should devote its resources to the latter rather than the former. To illustrate this point, imagine choosing between two programs:

- (A) Program A would eliminate (at a stated cost of \$500) a 1/10,000 risk faced by fifty poor people in Costa Rica, each willing to pay \$2 to eliminate that risk.
- (B) Program B would eliminate (also at a stated cost of \$500) a 1/10,000 risk faced by fifty wealthy people in Germany, each willing to pay \$350 to eliminate that same risk.

In principle, there is no reason to think that a donor should prefer to save the Germans, even though their WTP is far higher than that of the Costa Ricans. In fact, Program A has much higher priority, because it would help people who were facing extreme deprivation. What is true at the individual level is true across nations as well.

But now consider a different issue. The government in a poor nation is deciding on appropriate policy to reduce workplace risks; what VSL should it use? At least under the assumptions that I have given thus far, such a government would do well to begin by using the admittedly low WTP of its own citizens. If citizens in that nation show a WTP of \$2 to eliminate risks of 1/10,000, then their government does them no favors by requiring them to pay \$50 or \$10 for that protection. This is the sense in which VSL properly varies across nations, and in which citizens of poor nations have lower VSLs than citizens of wealthy ones.

The point has strong implications for international labor standards. It is tempting to suggest that workers in poor countries, for example China and India, should receive the same protection as those in the United States; why should a worker in Beijing be subject to significantly higher death risks than a worker in Los Angeles? So long as the distribution of global income has the form that it does, a system that gives Chinese workers the same protection as American workers is not in the interest of Chinese workers—assuming, as I am, that the cost of that protection is borne by workers themselves. Requiring Chinese workers to have the same protection as Americans amounts to a forced exchange on terms that Chinese workers reject.

In these circumstances it is unsurprising that workers in wealthy nations, not in poor ones, often clamor the loudest for greater protection of workers in poor nations; workers in wealthier nations would be the principal beneficiaries of such regulation, which would protect them against competition from those in poorer nations. The

idea that workers in poor nations should have the “same” protection as workers in wealthy nations is an error, rooted in a “moral heuristic” involving the equal worth of all human lives—a heuristic that sometimes works well but that also misfires.¹⁹⁰ The real question is the effect of different numbers.

If the Chinese government uses a VSL of \$6 million, on the theory that its citizens should not be valued less than those of wealthy nations, social harm will almost inevitably result. In the easy cases, the forced exchanges will be ludicrously harmful to the people whom they are supposed to help. In the hard cases, in which the beneficiaries pay only a fraction of the cost (which is mostly borne by others in the same nation), the nation will be spending far too much of its money on risk reduction (or more precisely, on reducing the risks that happen to get onto the regulatory agenda). The inefficiency of an extremely high VSL will be felt acutely and in many forms, including decreased employment. But if the costs of risk reduction will be paid by third parties—for example, wealthy nations—then people in the poor country will be helped even if risk reduction is based on an excessive VSL.

Of course the citizens of poor nations would almost certainly be helped more if they were given cash (supposing that it would not be squandered) rather than in-kind benefits. But if cash redistribution is not possible, regulatory benefits, provided for free or for a fraction of their cost, remain a blessing. If, for example, a global institution uses a worldwide VSL of \$1 million, and if that amount exceeds the domestic VSL of people in poor nations, it is possible that poor people will gain a great deal if the resources for risk reduction are provided by wealthy nations. In the harder cases, the simple point is that many of the intended beneficiaries of regulation are in fact net gainers.

B. Policy and Practice

How, then, should global institutions, such as the Intergovernmental Panel on Climate Change, assess the monetary costs of risks faced by people all over the world? As I have suggested, the answer turns on the purpose of the assessment—on what issue the answer is supposed to address. There is no good acontextual way of

190. On moral heuristics, see generally Cass R. Sunstein, *Moral Heuristics and Moral Framing*, 88 MINN. L. REV. 1556 (2004).

asking some question about the aggregate costs of global climate change by 2050, unless it has some particular point. A far more sensible question is whether it would make sense for any particular nation to accept a particular way of responding to the problem of climate change, such as the Kyoto Protocol.¹⁹¹ At the national level, an assessment of the costs and benefits of the Kyoto Protocol is not much different from an assessment of the costs and benefits of any other regulation.

For the United States, the likely costs of the Kyoto Protocol greatly exceed its likely benefits. The anticipated costs are \$325 billion,¹⁹² an amount that might be worthwhile if the anticipated benefits for the United States were in the ballpark of that number. But the overall benefits of the Kyoto Protocol are small because the mandatory emissions reduction would make only a slight dent in global warming.¹⁹³ In the United States, the benefits could not possibly justify the costs.¹⁹⁴ The picture for the world as a whole is more mixed, with Europe anticipated to be a net gainer.¹⁹⁵ But even for the world, the Kyoto Protocol appears to impose costs in excess of benefits—and this is so even if improbable catastrophic risks are taken into account. The only qualification here is that the science of global warming is disputed; if this is a realm of uncertainty rather than risk, and if worst-case scenarios are emphasized, then the Kyoto Protocol might provide a sensible impetus toward technological innovation and far more dramatic reductions.

For wealthy nations, of course, the argument for contributing to the reduction of global warming is strengthened by the fact that the harms of global warming will be felt disproportionately in poor nations—and also by the fact that wealthy nations have done by far the most to produce the situation that makes global warming a serious problem. Hence it is reasonable to say that the United States should join international agreements to combat global warming even if it loses more than it gains. The problem with the Kyoto Protocol is

191. See WILLIAM D. NORDHAUS & JOSEPH BOYER, *WARMING THE WORLD: ECONOMIC MODELS OF GLOBAL WARMING* 168 (2000) ("Finally, the Kyoto Protocol has significant distributional consequences . . . The lion's share of the[] costs are borne by the United States. Indeed, the United States is a net loser while the rest of the world on balance benefits from the Kyoto Protocol.").

192. *Id.* at 161.

193. *Id.* at 152.

194. *Id.* at 130-31 & tbl.7.4.

195. *Id.* at 162.

that it combines extremely high global costs with relatively low global benefits, even if the problem of global warming is taken quite seriously. A sensible approach would control emissions in developing countries, so as to increase the overall benefits, and also would use emissions trading and other strategies to reduce the overall costs. These routes could certainly produce sensible agreements to address climate change.¹⁹⁶ To the extent that emissions control in developing countries would impose a significant burden, wealthy nations should help to foot the bill.

But I am not attempting here to resolve any particular controversy. My major suggestions are that within nations, diverse VSLs are perfectly sensible, and that answers to questions about valuation must be closely attuned to the purposes for which those questions are being asked.

CONCLUSION

The theory that animates current valuations of mortality risks argues in favor of far more individuation. Does the risk involve cancer? What kind of cancer? Does it involve air pollution or driving on the highways? If welfare and autonomy are the guides, it is obtuse to adopt an approach that values all statistically equivalent mortality risks in the same way. In addition, individuals display a great deal of heterogeneity in their VSLs—not simply because of different tastes and values, but also because of different levels of income and wealth. WTP depends on ability to pay. Nothing that I have said here is meant to suggest approval of existing distributions of resources. Certainly poor people are not “worth less” than wealthy ones, and it is often appropriate for government to provide resources directly to poor people or subsidize the provision of regulatory benefits. But forced exchanges are not a good way to assist poor people, and a uniform VSL is often a perverse response to inequality. In theory, risk-reduction policies should be more fully individuated, giving all people regulatory protection that corresponds to their WTP for the particular risk in question.

Of course this is not practicable. Government lacks the necessary information about individual risk preferences; categorical judgments are inevitable. In any case many of the benefits provided by

196. RICHARD B. STEWART & JONATHAN B. WIENER, RECONSTRUCTING CLIMATE POLICY 38–40, 102–09 (2003).

regulation are collective in character. Regulators cannot feasibly provide protection to one person without simultaneously providing protection to many. But it is nonetheless important to see what the current theory counsels in principle, and to understand that the limitations are practical ones, some of which may be overcome as knowledge progresses. Even with the practical limitations, a uniform VSL is increasingly difficult to justify.

It is clear that some risks produce a higher VSL than others, resulting in significantly different analyses in many cases, above all by producing a higher VSL for cancer risks. A program that protects elderly people should produce a lower VSL than one that protects younger people, and there is no ethical objection to variations on the basis of age.¹⁹⁷ If a program affects mostly wealthy people, a VSL based on the population-wide median will be too low. It would follow that the FAA should have a relatively high VSL, because people who fly are wealthier than the population median—and when the EPA is engaging in cost-benefit analysis for programs protecting poor people from risks associated with hazardous waste sites, it should have a relatively low VSL.

The principal qualification is that when the beneficiaries of regulation do not pay all of its cost, a high VSL may actually be in their interests. The easy cases, in which the beneficiaries are forced to pay for regulatory benefits, are not the same as those in which beneficiaries pay only a fraction of the cost. Nonetheless, current practice treats such cases as identical, perhaps because of the great difficulty in untangling the incidence of regulatory benefits and costs. My goal has not been to resolve that difficulty, but to suggest that the theory behind current practice justifies far more individuation of VSL than regulators currently provide. However regulators deal with distributional problems and the hardest cases, the use of a uniform VSL is unacceptably obtuse.

197. See Aldy & Viscusi, *supra* note 15, at 24 (“[W]orkers . . . in their early 60s have a VSL . . . about 30–40 percent lower than the market average and between one-third and one-half the size of the VSLs for prime-aged workers.”); Sunstein, *supra* note 8, at 210 (“If thirty-year-olds are willing to pay more (or less) to eliminate a statistical risk than sixty-year-olds, then the difference should be reflected in cost-benefit analyses of regulatory proposals. . . . [P]olicymakers should use different values for old people and young people if and only if WTP studies show such a disparity.”). I am putting to one side the difficult questions raised by the need to produce a VSL for children.



The Journal of Risk and Uncertainty, 27:1; 5–76, 2003
© 2003 Kluwer Academic Publishers. Manufactured in The Netherlands.

The Value of a Statistical Life: A Critical Review of Market Estimates Throughout the World

W. KIP VISCUSI*

kip@law.harvard.edu

*John F. Cogan Jr. Professor of Law and Economics, Harvard Law School, Hauser Hall 302, Cambridge,
MA 02138, USA*

JOSEPH E. ALDY

Department of Economics, Harvard University, USA

Abstract

A substantial literature over the past thirty years has evaluated tradeoffs between money and fatality risks. These values in turn serve as estimates of the value of a statistical life. This article reviews more than 60 studies of mortality risk premiums from ten countries and approximately 40 studies that present estimates of injury risk premiums. This critical review examines a variety of econometric issues, the role of unionization in risk premiums, and the effects of age on the value of a statistical life. Our meta-analysis indicates an income elasticity of the value of a statistical life from about 0.5 to 0.6. The paper also presents a detailed discussion of policy applications of these value of a statistical life estimates and related issues, including risk-risk analysis.

Keywords: value of statistical life, compensating differentials, safety, risk-risk analysis

JEL Classification: I10, J17, J28

Introduction

Individuals make decisions everyday that reflect how they value health and mortality risks, such as driving an automobile, smoking a cigarette, and eating a medium-rare hamburger. Many of these choices involve market decisions, such as the purchase of a hazardous product or working on a risky job. Because increases in health risks are undesirable, there must be some other aspect of the activity that makes it attractive. Using evidence on market choices that involve implicit tradeoffs between risk and money, economists have developed estimates of the value of a statistical life (VSL). This article provides a comprehensive review and evaluation of the dozens of such studies throughout the world that have been based on market decisions.¹

These VSL estimates in turn provide governments with a reference point for assessing the benefits of risk reduction efforts. The long history of government risk policies ranges from the draining of swamps near ancient Rome to suppress malaria to the limits on air pollution in developed countries over the past 30 years (McNeill, 1976; OECD, 2001). All such policy choices ultimately involve a balancing of additional risk reduction and incremental costs.

*To whom correspondence should be addressed.

AB73-BKG-25

The proper value of the risk reduction benefits for government policy is society's willingness to pay for the benefits. In the case of mortality risk reduction, the benefit is the value of the reduced probability of death that is experienced by the affected population, not the value of the lives that have been saved *ex post*. The economic literature has focused on willingness-to-pay (willingness-to-accept) measures of mortality risk since Schelling's (1968) discussion of the economics of life saving.

Most of this literature has concentrated on valuing mortality risk by estimating compensating differentials for on-the-job risk exposure in labor markets. While the early studies assessed such compensating differentials in the United States, much of the more recent work has attempted to estimate risk-money tradeoffs for other developed and some developing countries. In addition, economists have also investigated price-risk (price-safety) tradeoffs in product markets, such as for automobiles and fire alarms.

Use of the economic research on the value of mortality and injury risks in government policy evaluation has been a key benefit component of policy evaluations for a wide range of health, safety, and environmental policies. The policy use of risk valuations, however, has raised new questions about the appropriateness of these applications. How should policymakers reconcile the broad range of VSL estimates in the literature? Should the value of a statistical life vary by income? Should the VSL vary by the age distribution of the affected population? What other factors may influence the transfer of mortality risk valuation estimates from journal articles to policy evaluation in different contexts?

We begin our assessment of this literature with an overview of the hedonic wage methodology in Section 1. This approach motivates the discussion of the data and econometric issues associated with estimating a VSL. Although there continue to be controversies regarding how best to isolate statistically the risk-money tradeoffs, the methodologies used in the various studies typically follow a common strategy of estimating the locus of market equilibria regarding money-risk tradeoffs rather than isolating either market supply curves or market demand curves.

Section 2 examines the extensive literature based on estimates using U.S. labor market data, which typically show a VSL in the range of \$4 million to \$9 million. These values are similar to those generated by U.S. product market and housing market studies, which are reviewed in Section 3. A parallel literature reviewed in Section 4 examines the implicit value of the risk of nonfatal injuries. These nonfatal risks are of interest in their own right and as a control for hazards other than mortality risks that could influence the VSL estimates.

Researchers subsequently have extended such analyses to other countries. Section 5 indicates that notwithstanding the quite different labor market conditions throughout the world, the general order of magnitude of these foreign VSL estimates tends to be similar to that in the United States. International estimates tend to be a bit lower than in the United States, as one would expect given the positive income elasticity with respect to the value of risks to one's life.

A potentially fundamental concern with respect to use of VSL estimates in different contexts is how these values vary with income. While the income elasticity should be positive on theoretical grounds, extrapolating these values across different contexts requires an empirical estimate of this elasticity. Our meta-analyses of VSL estimates throughout the world in Section 6 imply point estimates of the income elasticity in the range of 0.5 to 0.6.

The meta-analysis also provides a characterization of the uncertainty around the measures of central tendency for the value of a statistical life, i.e., 95 percent confidence intervals for the predicted VSLs. Heterogeneity in VSL estimates based on union status (Section 7) and age (Section 8) indicate that the VSL not only varies by income but also across these important labor market dimensions. The existence of such heterogeneity provides a cautionary note for policy. While policymakers have relied on VSL estimates to an increasing degree in their benefit assessments, as Section 9 indicates, matching these values to the pertinent population at risk is often problematic, particularly for people at the extreme ends of the age distribution.

1. Estimating the value of a statistical life from labor markets

1.1. The hedonic wage methodology

More than two centuries ago, Adam Smith (1776) noted in *The Wealth of Nations* that: “The wages of labour vary with the ease or hardship, the cleanliness or dirtiness, the honourableness or dishonourableness of the employment” (p. 112). Finding empirical evidence of such compensating differentials, however, has been problematic. Because of the positive income elasticity of the demand for safety, the most attractive jobs in society tend to be the highest paid. To disentangle the wage-risk tradeoff from the other factors that affect wages, economists have relied on statistical models that control both for differences in worker productivity as well as different quality components of the job. The primary approach has been hedonic wage and hedonic price models that examine the equilibrium risk choices and either the wage levels or price levels associated with these choices.² Market outcomes reflect the joint influence of labor demand and labor supply, but hedonic models do not examine the underlying economic structure that gives rise to these outcomes. For concreteness, we focus on the hedonic wage case.

The firm’s demand for labor decreases with the total cost of employing a worker. The cost of a worker may include the worker’s wage; training; benefits such as health insurance, vacation, child care; and the costs of providing a safe working environment. Because worker costs increase with the level of safety, for any given level of profits the firm must pay workers less as the safety level rises. Figure 1 depicts two firms with wage-risk offer curves (isoprofit curves) with wage as an increasing function of risk, OC_1 for firm 1 and OC_2 for firm 2. For any given level of risk, workers prefer the wage-risk combination from the market offer curve with the highest wage level. The outer envelope of these offer curves is the market opportunities locus $w(p)$.

The worker’s supply of labor is in part a function of the worker’s preferences over wages and risk. The labor supply is best characterized subject to several mild restrictions on preferences. Consider a von Neumann-Morgenstern expected utility model with state-dependent utility functions.³ Let $U(w)$ represent the utility of a healthy worker at wage w and let $V(w)$ represent the utility of an injured worker at wage w . Typically, workers’ compensation after an injury is a function of the worker’s wage. We assume that the relationship between workers’ compensation and the wage is subsumed into the functional form of $V(w)$. Further, assume that workers prefer to be healthy than injured [$U(w) > V(w)$] and that the marginal utility of income is positive [$U'(w) > 0$, $V'(w) > 0$].⁴

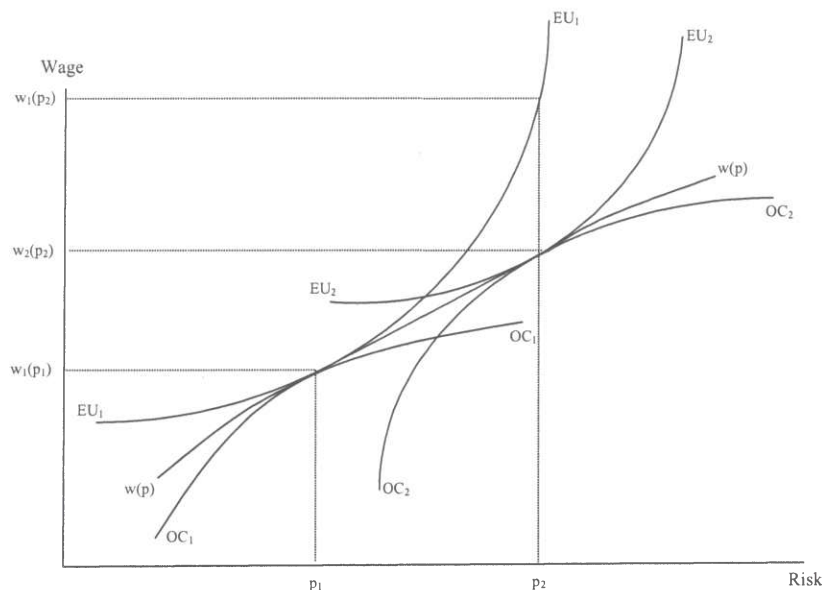


Figure 1. Market process for determining compensating differentials.

Workers choose from potential wage-risk combinations along some market opportunities locus $w(p)$ to maximize expected utility. In Figure 1, the tangency between the constant expected utility locus EU_1 and firm 1's offer curve OC_1 represents worker 1's optimal job risk choice. Likewise, worker 2 maximizes expected utility at the tangency between EU_2 and OC_2 . All wage-risk combinations associated with a given worker's constant expected utility locus must satisfy

$$Z = (1 - p)U(w) + pV(w).$$

The wage-risk tradeoff along this curve is given by

$$\frac{dw}{dp} = -\frac{Z_p}{Z_w} = \frac{U(w) - V(w)}{(1 - p)U'(w) + pV'(w)} > 0,$$

so that the required wage rate is increasing in the risk level. The wage-risk tradeoff consequently equals the difference in the utility levels in the two states divided by the expected marginal utility of income.

Actual labor market decisions by workers can be depicted by the wage-risk combinations at the tangencies of the offer curves and expected utility loci at points (p_1, w_1) and (p_2, w_2) . All that is observable using market data are these points of tangency. Expanding beyond our two worker example, observations of a large set of workers can show the locus of

these workers' wage-risk tradeoffs, depicted by the curve $w(p)$ in Figure 1. Hedonic wage analyses trace out points on this $w(p)$ curve that workers find acceptable.

The observed labor market decisions (p_i, w_i) reflect the joint influence of supply and demand on the market equilibrium. The estimated tradeoff between wage and risk, $\partial w / \partial p$, is a local measure of the wage-risk tradeoff for marginal changes in risk. This estimated slope corresponds to both the worker's marginal willingness to accept risk and the worker's marginal willingness to pay for more safety and the firm's marginal cost of more safety as well as the firm's marginal cost reduction from an incremental increase in risk. For the worker and firm associated with a given labor market decision (p_i, w_i) , $\partial w_i / \partial p_i$ reflects both the marginal supply price and the marginal demand price of risk. Econometric models that estimate a linear $w(p)$ curve are estimating an average tradeoff rate across different levels of risk.

The estimated wage-risk tradeoff curve $w(p)$ does not imply how a particular worker must be compensated for non-marginal changes in risk. Consider workers 1 and 2 in Figure 1. Worker 2 has revealed a willingness to accept risk p_2 at wage $w_2(p_2)$ along EU_2 . A change in the risk exposure to worker 1 from p_1 to p_2 would require a higher wage compensation to keep worker w_1 on the expected utility locus (EU_1), implying that $w_1(p_2) > w_2(p_2)$ (or alternatively, that $\partial w_1 / \partial p_2 > \partial w_2 / \partial p_2$). With large changes in risk, a worker's wage-risk tradeoff will not be the same because the relevant tradeoff must be made along the worker's expected utility locus, not the estimated market wage-risk tradeoff.

1.2. *Econometrics and data issues in hedonic labor market analysis*

Most researchers estimate the wage-risk relationship in labor markets by specifying a wage equation along the lines of the following:

$$w_i = \alpha + H_i' \beta_1 + X_i' \beta_2 + \gamma_1 p_i + \gamma_2 q_i + \gamma_3 q_i WC_i + p_i H_i' \beta_3 + \varepsilon_i$$

where w_i is the worker i 's wage rate, α is a constant term, H is a vector of personal characteristic variables for worker i , X is a vector of job characteristic variables for worker i , p_i is the fatality risk associated with worker i 's job, q_i is the nonfatal injury risk associated with worker i 's job, WC_i is the workers' compensation benefits payable for a job injury suffered by worker i , and ε_i is the random error reflecting unmeasured factors influencing worker i 's wage rate. The terms α , β_1 , β_2 , β_3 , γ_1 , γ_2 , and γ_3 represent parameters estimated through regression analysis.

The personal characteristic variables represented by H_i often include a variety of human capital measures, such as education and job experience, as well as other individual measures, such as age and union status. The job characteristic variables represented by X often include indicators for blue-collar jobs, white-collar jobs, management positions, the worker's industry, and measures of physical exertion associated with the job. These two sets of variables reflect both workers' preferences over jobs as well as firms' offer curves for labor. Some studies interact personal characteristics H_i with the fatality risk p_i to capture how the returns to risk may vary with these characteristics, such as age and union status.

1.2.1. Risk data. An ideal measure of on-the-job fatality and injury risk would reflect both the worker's perception of such risk and the firm's perception of the risk. Because the market opportunity locus reflects both workers' preferences over income and risk and firms' preferences over costs and safety, information on both sets of beliefs would be necessary to appropriately characterize the risk premium. However, very few studies have compiled workers' subjective preferences regarding risks (Viscusi, 1979; Viscusi and O'Connor, 1984; Gerking, de Haan, and Schulze, 1988; Liu and Hammitt, 1999) and there is no available research on firms' risk perceptions. If individuals' and firms' subjective risk perceptions closely reflect objective measures of fatality risk, then such objective risk data could be used instead as a proxy for unobserved subjective risk data.⁵ The standard approach in the literature is to use industry-specific or occupation-specific risk measures reflecting an average of at least several years of observations for fatalities, which tend to be relatively rare events.⁶

Measures of job-related fatality and injury risk have included self-reported risks based on worker surveys and objective risk measures derived from actuarial tables, workers' compensation records, and surveys and censuses of death certificates. The choice of the measure of fatality risk can significantly influence the magnitude of the risk premium estimated through regression analysis. The nature of the risk measures also raise questions about possible errors in estimation and the need to correct the econometric specification to address them.

Several early papers on compensating differentials used the University of Michigan Survey of Working Conditions and Quality of Employment Survey data that include several qualitative measures of on-the-job risk. These measures utilize direct surveys of workers and their perceptions of their work environment. For example, Hamermesh (1978), Viscusi (1979, 1980), and Fairris (1989) estimated the hedonic wage equation with a dichotomous measure of injury risk based on a worker's perception of whether his or her job is "dangerous."⁷ The survey asked workers if their job exposed them to physical dangers or unhealthy conditions. These studies estimated statistically significant coefficients on this "risk" variable in some of the specifications. Duncan and Holmlund (1983) undertook a similar analysis of compensating differentials with a "danger" variable in a study of male workers in Sweden.

Several papers on the U.S. labor market from the 1970s and early 1980s used actuarial data (Thaler and Rosen, 1975; Brown, 1980; Leigh, 1981; Arnould and Nichols, 1983). These studies all employed a job-related risk measure based on data collected by the Society of Actuaries for 1967. The Society of Actuaries data set provides fatality risk data for 37 occupations. Across these 37 occupations, the annual risk averaged approximately 1 in 1,000. This fatality risk exceeds averages from other data sets by nearly an order of magnitude. To the extent that these data reflect workers in extremely high risk jobs, the estimated wage-risk tradeoffs will suffer from a selection bias. As a result, one would expect these estimates to be lower than found in more broadly representative samples, which has in fact proven to be the case.

Another difficulty is that the Society of Actuaries data do not distinguish fatalities caused by the job but rather reflect the overall fatality rates of people within a particular job category. For example, one of the highest risk occupations based on these actuarial ratings is actors, who typically face few risks other than unfavorable reviews.

Several studies of U.S. and Canadian labor markets have used workers' compensation records to construct risk measures (Butler, 1983; Dillingham, 1985; Leigh, 1991; Martinello and Meng, 1992; Meng, 1991; Cousineau, Lacroix, and Girard, 1992; Lanoie, Pedro, and LaTour, 1995). Only three studies have used workers' compensation data to evaluate compensating differentials in U.S. labor markets, which may reflect the decentralized nature and differences in information collection associated with state (not Federal) management of U.S. workers' compensation programs.⁸ In contrast, researchers in Canada can obtain workers' compensation-based risk data from Labour Canada (the labor ministry for the Federal government) and the Quebec government.

For analyses of the United States, the majority of the mortality risk studies have used data collected by the U.S. Department of Labor Bureau of Labor Statistics (BLS). About 80 percent of the U.S. nonfatal injury risk studies summarized below used BLS injury risk data. The BLS has compiled industry-specific fatality and injury risk data since the late 1960s. Through the early 1990s, BLS collected its data via a survey of industries, and reported the data at a fairly aggregated level, such as at the 2-digit and 3-digit Standard Industrial Classification (SIC) code level. The aggregation and sampling strategy have elicited some concerns about measurement error in the construction of the mortality risk variable (see Moore and Viscusi, 1988a).

Concerns about the BLS fatality risk data led the National Institute of Occupational Safety and Health (NIOSH) to collect information on fatal occupational injuries through its National Traumatic Occupational Fatalities surveillance system (NTOF) since 1980. NIOSH compiles these data from death certificates managed by U.S. vital statistics reporting units (NIOSH, 2000). These data are reported at the 1-digit SIC code level by state. Because NIOSH compiles data from a census of death certificates, it circumvents some of the concerns about sampling in the pre-1990s BLS approach. Some have raised concerns, however, about the accuracy of the reported cause of death in death certificates (Dorman and Hagstrom, 1998).

Comparing the BLS and NIOSH fatality risk data over time provides some interesting contrasts. The original NIOSH data set for the fatality census averaged over 1980–1985 has a mean fatality risk nearly 50 percent higher than a roughly comparable BLS data set averaged over 1972–1982.⁹ Moreover, the BLS data had greater variation (a standard deviation 95 percent greater than its mean) than the NTOF data, although the NIOSH data also had substantial variation (standard deviation 23 percent greater than its mean) (Moore and Viscusi, 1988a).

Since 1992, the BLS has collected fatal occupational injury data through the Census of Fatal Occupational Injuries (CFOI). The BLS compiles information about each workplace fatality including worker characteristics and occupation, circumstances of the event, and possible equipment involved. The BLS draws on multiple sources such as death certificates, workers' compensation records, and other Federal and state agency reports. The BLS reports these fatality data by industry at the 4-digit SIC level. In contrast to the earlier comparisons of BLS and NIOSH data, more recent years' data on fatality risk collected through the CFOI now show that the BLS measure includes approximately 1,000 more fatalities per year than the NIOSH measure (NIOSH, 2000). Table 1 illustrates the recent national rates of job-related fatalities at the one-digit industry level for the four-year period in which both

Table 1. U.S. Occupational fatality rates by industry, 1992–1995 national averages.

Industry	Fatality rate per 100,000 workers	
	NIOSH (NTOF)	BLS (CFOI)
Agriculture, Forestry, & Fisheries	17.0	23.9
Mining	24.5	26.3
Construction	12.8	13.4
Manufacturing	3.6	3.8
Transportation & Utilities	10.4	10.6
Wholesale Trade	3.5	5.4
Retail Trade	2.8	3.6
Finance, Insurance, & Real Estate	1.1	1.5
Services	1.5	1.8

Sources: Rates constructed by authors based on Marsh and Layne (2001) and BLS (n.d.).

NIOSH and CFOI data are publicly available. In every instance the BLS measure shows a higher risk mortality rate, which in some cases, such as wholesale trade, is quite substantial.

The risk variables used in several of the non-U.S. studies were based on job-related accident and mortality data collected by foreign governments. For example, the data sets used in Shanmugam (1996/7, 1997, 2000, 2001) were from the Office of the Chief Inspector of Factories in Madras. Several of the United Kingdom studies employ data provided by the Office of Population Censuses and Surveys (Marin and Psacharopoulos, 1982; Sandy and Elliott, 1996; Arabsheibani and Marin, 2000) while others used unpublished data from the U.K. Health and Safety Executive (Siebert and Wei, 1994). In their study of the South Korean labor market, Kim and Fishback (1999) obtained their accident data from the Ministry of Labor. Few of these studies indicate whether the mortality risk data were derived from samples or censuses of job-related deaths.

While the large number of studies of labor markets around the world evaluated the compensating differential for an on-the-job death and/or on-the-job injury, very few attempted to account for the risk of occupational disease. Lott and Manning (2000) used an alternative data set to estimate the risk premium for jobs with higher cancer risk associated with occupational exposure to various chemicals (see Section 2).

1.2.2. Wages and related data. Labor market studies of the value of risks to life and health match these risk measures to data sets on characteristics of wages, workers, and employment. Some researchers survey workers directly to collect this information, such as Gegax, Gerking, and Schulze (1991) for the United States, Lanoie, Pedro, and LaTour (1995) for Canada, Shanmugam (1996/7) for India, and Liu and Hammitt (1999) for Taiwan, among others. For the United States, researchers have also used the University of Michigan's Survey of Working Conditions (SWC), the Quality of Employment Survey (QES), the Bureau of Labor Statistics' Current Population Survey (CPS), the Panel Study of Income Dynamics

(PSID), and decennial census data. Similar types of surveys undertaken in other countries have also provided the data necessary to undertake hedonic labor market analysis, such as the General Household Survey in the United Kingdom (e.g., Siebert and Wei, 1994; Arabsheibani and Marin, 2000).

The dependent variable in virtually all labor market analyses has been a measure of the hourly wage. With some data sets, researchers have had to construct the wage measure from weekly or annual labor earnings data. For some data sets, a worker's after-tax wage rate is provided, which can put wage and workers' compensation benefits in comparable terms. While many studies have included pre-tax wages as the dependent variable, this would not likely bias the results significantly so long as workers' income levels and tax rates do not differ substantially. If the regression model includes workers' compensation benefits, then both the wage and these benefits should be expressed in comparable terms (both in after-tax or both in pre-tax terms) to ensure proper evaluation of the benefits' impacts on wages.¹⁰

Typically, researchers match a given year's survey data on wages and worker and employment characteristics with risk data for that year, or preferably, the average over a recent set of years. Some researchers have restricted their samples to subsets of the surveyed working population. For example, it is common to limit the analysis to full-time workers, and many have focused only on male, blue-collar workers. Restricting the sample in this manner partially addresses the measurement problem with industry-level risk values common to most risk data sets by including only those workers for whom the risk data are most pertinent.

1.2.3. Wage vs. $\log(\text{wage})$. Most researchers have estimated the wage equation using linear and semi-logarithmic specifications. Choosing a preferred functional form from these two specifications cannot be determined on theoretical grounds (see Rosen, 1974). To identify the specification with greatest explanatory power, Moore and Viscusi (1988a) employed a flexible functional form given by the Box-Cox transformation. The Box-Cox transformation modifies the dependent variable such that the estimated regression model takes the form:

$$\frac{w_i^\lambda - 1}{\lambda} = \alpha + H_i' \beta_1 + X_i' \beta_2 + \gamma_1 p_i + \gamma_2 q_i + \gamma_3 q_i WC_i + p_i H_i' \beta_3 + \varepsilon_i.$$

This approach presumes that a λ exists such that this model is normally distributed, homoskedastic, and linear in the regressors. Note that the case where $\lambda \rightarrow 0$ represents the semi-logarithmic functional form and the case where $\lambda \rightarrow 1$ represents the linear functional form. The flexible form under the Box-Cox transformation can test the appropriateness of these two restrictions on the form of the model. Using maximum likelihood methods, Moore and Viscusi's estimate for λ equaled approximately 0.3 for their data. While this value is more consistent with a semi-logarithmic form than a linear form, the authors reject both specifications based on a likelihood ratio test. The estimated value of a statistical life based on the Box-Cox transformed regression model, however, differed only slightly from the $\log(\text{wage})$ specification. Shanmugam (1996/7) replicated this flexible form evaluation with his evaluation of compensating differentials in India. His maximum likelihood estimate for λ equaled approximately 0.2. While Shanmugam rejected the semi-logarithmic and linear models, he found that the semi-logarithmic functional form also generated results closer to those found with the unrestricted flexible form.¹¹

1.2.4. Errors in variables problem with risk measures. Every compensating differential study employs a less than perfect measure of any particular worker's job-related fatality risk. The majority of these studies have used fatality risk measures from the BLS averaged across entire industries. Such an approach, however, suffers from measurement error. As noted above, some researchers have found that the pre-1992 BLS data sets (and NIOSH data sets to a lesser extent) suffer from incomplete reporting. The industry averages constructed by the BLS do not exactly reflect realized industry averages. Further, applying industry averages to individuals may result in errors associated with matching workers to industries due to response error in worker surveys. Mellow and Sider (1983) evaluated several surveys that asked workers and their employers to identify the workers' industry and occupation (among other questions). In their assessment of the January 1977 Current Population Survey, 84 percent of workers and their employers agreed on industry affiliation at the three-digit SIC code level while only 58 percent agreed on the three-digit occupational status. Merging a worker characteristics data set with a risk measure data set based on industry affiliation (or occupation status) can result in a mismatch of worker characteristics and industry risk. Mellow and Sider's statistical analysis of the 16 percent "mismatched" workers by industry affiliation showed that the errors in matching reduced the compensating differential for injury risk by about 50 percent in their samples.

Even with a perfect industry measure of fatality risk and appropriate matching of workers and their industry, measurement error still exists since some workers bear risk that differs from their industry's average. For example, different occupations within an industry may pose different levels of risk. This measurement error can be characterized as:

$$p_i = p_i^* + \eta_i,$$

where p_i reflects the observed industry average fatality risk, p_i^* reflects the unobserved (to the econometrician) fatality risk associated with worker i 's job, and η_i reflects the deviation of that job's risk from the industry average. Random measurement error will result in a downward bias on coefficient estimates, and the least squares estimate of the coefficient on fatality risk in this example would be inconsistent:

$$\hat{\gamma}_{1,OLS} \xrightarrow{p} \left(\frac{\sigma_p^2}{\sigma_p^2 + \sigma_\eta^2} \right) \gamma_1$$

where the signal-noise ratio determines the extent of the downward bias towards zero.

In addition to the downward effect on the risk coefficient, applying industry-level risk data to individual observations may also induce some correlation in the residuals among individuals within industries. Robust (White) standard errors would not appropriately correct for this correlation and result in inappropriately small standard errors. Hersch (1998) and Viscusi and Hersch (2001) employ robust standard errors correcting for within-group (within-industry) correlation.

1.2.5. Omitted variables bias and endogeneity. Failing to capture all of the determinants of a worker's wage in a hedonic wage equation may result in biased results if the unobserved

variables are correlated with observed variables. Dangerous jobs are often unpleasant in other respects. Omission of non-pecuniary characteristics of a job may bias the estimated risk premium if an omitted variable is correlated with risk. For example, one may find a correlation between injury risk and physical exertion required for a job or risk and environmental factors such as noise, heat, or odor. While some studies have attempted to control for these unobservables by including industry or occupation dummy variables (see below), a model may still suffer from omitted variables bias.

Several studies have explored how omitting injury risk affects the estimation of mortality risk. Viscusi (1981) found that omitting injury risk resulted in a positive bias in the mortality risk measure for union affiliated workers. Cousineau, Lacroix, and Girard (1992) also found that omitting injury risk may cause a positive bias in the estimation of the coefficient on mortality risk. The high correlation (collinearity) between injury and mortality risks, however, can make joint estimation difficult. Some studies have attempted to estimate regression equations with both types of risk and have found non-significant coefficients on at least one of the measures, including Smith (1976), Leigh (1981), Dillingham and Smith (1984) and Kniesner and Leeth (1991).

While including injury risk in a regression model could address concern about one omitted variable, other possible influences on wages that could be correlated with mortality risk may not be easily measured. Several papers have investigated this bias. Garen (1988) notes that "individuals may systematically differ in unobserved characteristics which affect their productivity and earnings in dangerous jobs and so these unobservables will affect their choice of job risk" (p. 9). One example Garen offers is "coolheadedness," which may make a worker more productive under the stresses of a dangerous job but may not be relevant in a safe job. In this case, an econometrician would prefer to include both the mortality risk variable and the interaction or the mortality risk variable with a variable measuring coolheadedness as regressors in the hedonic labor market model. Failing to include this interaction term results in biased least squares estimation. Garen attempts to address this concern with an instrumental variables technique, although subsequent researchers such as Hwang, Reed, and Hubbard (1992) have noted the difficulty in identifying appropriate instruments for his procedure. Employing this instrumental variables technique, Garen found a mortality risk premium about double what the standard least squares model produced.

The significant increase in the risk premium associated with a method to account for unobserved productivity is consistent with the theoretical and simulation findings in Hwang, Reed, and Hubbard (1992). They estimate that for plausible parameter estimates, models that fail to account for heterogeneity in unobserved productivity may bias estimates of the risk premium by about 50 percent and could result in incorrectly (negative) signing of the risk variable. With the exception of some non-union samples in several studies (e.g., Dorsey, 1983; Dickens, 1984), the empirical literature presents very little evidence of this wrong signing. Siebert and Wei (1994) have also found that accounting for the endogeneity of risk can increase the risk premium compared to a standard least squares approach. Recent theoretical research, however, has also illustrated the potential for over-estimating the risk premium by failing to control for unobservables (Shogren and Stamland, 2002). They note that workers with the ability to avoid injury select into risky jobs while those less able to avoid

injury (“clumsy” workers) select into less-risky jobs. They argue that risk premiums could be overestimated by a factor of four with plausible parameter estimates in their simulations. Whether there will be such biases hinges on the monitorability of an individual’s safety-related productivity. If these differences are monitorable, as in Viscusi and Hersch (2001), there will be a separating compensating differential equilibrium for workers of different riskiness.

Viscusi and Hersch (2001) note that differences in workers’ preferences over risk can affect the shape of their indifference curves and workers’ safety behavior and, by affecting firms’ cost to supply safety, can influence firms’ offer curves. They evaluated the wage-risk (injury) tradeoff of workers with a data set that includes measures of risk preferences (e.g., smoking status) and measures of workers’ prior accident history. While smokers work, on average, in industries with higher injury risk than non-smokers, smokers also are more likely to have a work-related injury controlling for industry risk. Smokers also are more prone to have had a recent non-work-related accident. As a result, Viscusi and Hersch find that nonsmokers receive a greater risk premium in their wages than do smokers because the safety effect flattens smokers’ offer curves enough to offset smokers’ preferences for greater wages at higher risk levels.

To address potential omitted variable bias arising from differences in worker characteristics, employing a panel data set could allow one to difference out or dummy out individual-specific unobservables, so long as these are constant throughout the time period covered by the panel. Unfortunately, very few data sets exist that follow a set of workers over a period of several years. Brown (1980) used the National Longitudinal Study Young Men’s sample over 1966–1973 (excluding 1972) with the Society of Actuaries mortality risk data. While he reported results that were not consistent with the theory of compensating differentials for a variety of nonpecuniary aspects of employment, he did estimate a positive and statistically significant coefficient on the mortality risk variable. Brown noted that his estimate of the risk premium was nearly three times the size of the estimate in Thaler and Rosen (1975), which first used the Society of Actuaries mortality risk data.

1.2.6. Compensating differentials for risk or inter-industry wage differentials. Several recent papers have claimed that estimates of risk premiums in this kind of wage regression analysis actually reflect industry wage premiums because the fatality risk variables typically reflect industry-level risk (Leigh, 1995; Dorman and Hagstrom, 1998). Both Leigh and Dorman and Hagstrom evaluate the proposition that risk premiums simply reflect industry premiums by comparing compensating differential models without dummy variables for industry affiliation of each worker with models that include such dummy variables.

Their claim that industry premiums mask as risk premiums in these wage regressions suffers from several deficiencies. First, a large number of studies have included industry dummy variables in their statistical analyses and found significant compensating differentials for risk. For example, the first wage-risk tradeoff study by Smith (1974) employed six industry dummies and yielded a statistically significant compensating differential for risk. Viscusi (1978a) included 25 industry dummy variables in his analysis based on the Survey of Working Conditions *danger* variable (0, 1 variable reflecting a worker’s subjective perception of on-the-job risk), although he excluded the dummy variables from the analysis

based on the industry-level BLS risk data.¹² In both sets of analyses, *danger* and the BLS risk measure were statistically significant and generated very similar estimates of the risk premium. Freeman and Medoff (1981) found a statistically significant risk premium in their analyses that included 20 industry dummy variables and the BLS injury rate measure. In their evaluation of the U.K. labor market with an occupational mortality risk variable, Marin and Psacharopoulos (1982) found a statistically significant risk coefficient while their SIC code dummies were insignificant. Dickens (1984) estimated regression models with the BLS fatality risk measure and 20 industry dummy variables (1- and 2-digit SIC code industries). For the union sample, he found a positive and statistically significant coefficient on risk. Leigh and Folsom (1984) included 2-digit SIC code industry dummy variables in their wage regressions, and they found statistically significant coefficients on mortality risk in all eight mortality risk models reported. Dillingham (1985) estimated regression models with industry dummy variables (at the 1-digit SIC code level) and without. In both cases, he found statistically significant and positive coefficients on his measure of mortality risk. Moreover, the coefficients were virtually identical (0.0023 vs. 0.0022), although the standard error was higher for the model with industry dummy variables (perhaps related to risk-industry dummy variable collinearity). Cousineau, Lacroix, and Girard (1992) included 29 industry variables in their evaluation of the Canadian labor market that estimated statistically significant coefficients on both injury and mortality risks. Lott and Manning (2000) included 13 industry dummy variables in their evaluation of long-term cancer risks in U.S. labor markets, and found a statistically significant risk premium based on industry-level measures of carcinogen exposure.

Second, inserting industry dummy variables into the regression equation induces multicollinearity with the risk variable. Previous researchers such as Viscusi (1979) have noted this as well. Hamermesh and Wolfe (1990) employed dummy variables for five major industries in their analysis of injury risk on wages. They note that a finer breakdown by industry could be used. A complete set of dummy variables at the 3-digit SIC code level, however, would completely eliminate all variation in the injury risk variable, which is measured at the 3-digit SIC code level (p. S183). While multicollinearity does not affect the consistency of the parameter estimates, it will increase standard errors.

This induced multicollinearity is also evident in the Dorman and Hagstrom results for the models using NIOSH fatality risk data.¹³ Dorman and Hagstrom interact the NIOSH fatality risk measure by a dummy variable for union status (and for non-union status in the second set of regressions). Contrary to their hypothesis, including industry dummy variables does not reduce the coefficient in the union-risk interaction models. Inducing multicollinearity does depress the *t*-statistics slightly, although not enough to render the coefficients statistically insignificant. The models with the non-union-risk interaction reflect the induced multicollinearity, as the *t*-statistics fall below levels typically associated with statistical significance moving from the standard model to the industry dummy model. While the coefficients in these industry dummy-augmented models fall from their levels in the standard models, they are not statistically different from the standard models' coefficients. Based on the NIOSH fatality risk data, the Dorman and Hagstrom results appear to illustrate that including collinear regressors (industry variables) can increase standard errors but not significantly affect the magnitudes of the parameter estimates.

2. The value of a statistical life based on U.S. labor market studies

The value of a statistical life should not be considered a universal constant or some “right number” that researchers aim to infer from market evidence. Rather, the VSL reflects the wage-risk tradeoffs that reflect the preferences of workers in a given sample. Moreover, transferring the estimates of a value of a statistical life to non-labor market contexts, as is the case in benefit-cost analyses of environmental health policies for example, should recognize that different populations have different preferences over risks and different values on life-saving. If people face continuous safety choices in a variety of contexts, however, the same individual should exhibit the same risk-money tradeoff across different contexts, provided the character of the risks is the same. Researchers have undertaken more than 30 studies of compensating differentials for risk in the U.S. labor market. Some studies have evaluated the wage-risk tradeoff for the entire labor force, while others have focused on subsamples such as specific occupations (e.g., police officers in Low and McPheters, 1983), specific states (e.g., South Carolina in Butler, 1983), blue-collar workers only (e.g., Dorman and Hagstrom, 1998; Fairris, 1989), males only (e.g., Berger and Gabriel, 1991), and union members only (e.g., Dillingham and Smith, 1984). These hedonic labor market studies also vary in terms of their choice of mortality risk variable, which can significantly influence the estimation of a value of a statistical life (for comparison of NIOSH and BLS data, refer to Moore and Viscusi, 1988a; Dorman and Hagstrom, 1998).

Table 2 summarizes the estimated VSLs for the U.S. labor market from the literature over the past three decades.¹⁴ Because some studies provided multiple estimates, in these instances we provide illustrative results based on the principal specification in the analysis. Table 2 provides a sense of the magnitude and range of U.S. labor market VSLs and illustrates the influence of factors such as income and the magnitude of risk exposure as well as specification issues such as including nonfatal injury risk and worker’s compensation.¹⁵

Viscusi (1993) reported that most surveyed studies fall within a \$3.8–\$9.0 million range, when converted into year 2000 dollars.^{16,17} While we include more papers from the United States as well as findings from other countries, the general conclusion remains unchanged. Half of the studies of the U.S. labor market reveal a value of a statistical life range from \$5 million to \$12 million. Estimates below the \$5 million value tend to come from studies that used the Society of Actuaries data, which tends to reflect workers who have self-selected themselves into jobs that are an order of magnitude riskier than the average. Many of the studies yielding estimates beyond \$12 million used structural methods that did not estimate the wage-risk tradeoff directly or were derived from studies in which the authors reported unstable estimates of the value of a statistical life. Our median estimated VSL from Table 2 is about \$7 million, which is in line with the estimates from the studies that we regard as most reliable. In terms of methodology, we are more confident in the results presented in Viscusi (1978a, 1979), which include the most extensive set of non-pecuniary characteristics variables to explain workers’ wages, and the results presented in Moore and Viscusi (1988a), which include the NIOSH mortality risk data in lieu of the pre-1992 BLS mortality risk data.

A salient research issue of policy importance is the effect of income levels on the wage-risk tradeoff. For example, Hamermesh (1999) notes that as wage inequality has increased

THE VALUE OF A STATISTICAL LIFE

19

Table 2. Summary of labor market studies of the value of a statistical life, United States.

Author (Year)	Sample	Risk variable	Mean risk	Nonfatal risk included?	Workers' comp included?	Average income level (2000 US\$)	Implicit VSL (millions, 2000 US\$)
Smith (1974)	Current Population Survey (CPS) 1967, Census of Manufactures 1963, U.S. Census 1960, Employment and Earnings 1963	Bureau of Labor Statistics (BLS) 1966, 1967	0.000125	Yes, significant	No	\$29,029	\$9.2
Thaler and Rosen (1975)	Survey of Economic Opportunity 1967	Society of Actuaries 1967	0.001	No	No	\$34,663	\$1.0
Smith (1976)	CPS 1967, 1973	BLS 1966, 1967, 1970	0.0001	Yes, not significant	No	\$31,027	\$5.9
Viscusi (1978a, 1979)	Survey of Working Conditions, 1969–1970 (SWC)	BLS 1969, subjective risk of job (SWC)	0.0001	Yes, significant	No	\$31,842	\$5.3
Brown (1980)	National Longitudinal Survey of Young Men 1966–71, 1973	Society of Actuaries 1967	0.002	No	No	\$49,019	\$1.9
Viscusi (1981)	Panel Study of Income Dynamics (PSID) 1976	BLS 1973–1976	0.0001	Yes, significant	No	\$22,618	\$8.3
Olson (1981)	CPS 1978	BLS 1973	0.0001	Yes, significant	No	\$36,151	\$6.7
Arnould and Nichols (1983)	U.S. Census 1970	Society of Actuaries 1967	0.001	No	Yes	NA	\$0.5, \$1.3
Butler (1983)	S.C. workers' compensation data 1940–69	S.C. workers' compensation claims data	0.00005	No	Yes	\$22,713	\$1.3
Low and McPheters (1983)	International City Management Association 1976 (police officer wages)	Constructed a risk measure from DOJ/FBI police officers killed data 1972–75 for 72 cities	0.0003	No	No	\$33,172	\$1.4

(Continued on next page.)

Table 2. (Continued).

Author (Year)	Sample	Risk variable	Mean risk	Nonfatal risk included?	Workers' comp included?	Average income level (2000 US\$)	Implicit VSL (millions, 2000 US\$)
Dorsey and Walzer (1983)	CPS May 1978	BLS 1976	0.000052	Yes, significant	Yes	\$21,636	\$11.8, \$12.3
Leigh and Folsom (1984)	PSID 1974; Quality of Employment Survey (QES) 1977	BLS	0.0001	Yes, significant	No	\$29,038, \$36,946	\$10.1–\$13.3
Smith and Gilbert (1984, 1985)	CPS 1978	BLS 1975	NA	No	No	NA	\$0.9
Dillingham and Smith (1984)	CPS May 1979	BLS industry data 1976, 1979; NY workers' comp data 1970	0.000082	Yes, significant in some specifications	No	\$29,707	\$4.1–\$8.3
Dillingham (1985)	QES 1977	BLS 1976; NY workers' compensation data 1970	0.000008, 0.00014	No	No	\$26,731	\$1.2, \$3.2–\$6.8
Leigh (1987)	QES 1977; CPS 1977	BLS	NA	No	No	NA	\$13.3
Moore and Viscusi (1988a)	PSID 1982	BLS 1972–1982, NIOSH National Traumatic Occupational Fatality (NTOF) Survey 1980–1985	0.00005, 0.00008	No	Yes	\$24,931	\$3.2, \$9.4
Moore and Viscusi (1988b)	QES 1977	BLS, discounted expected life years lost; subjective risk of job (QES)	0.00006	No	Yes	\$31,092	\$9.7
Garen (1988)	PSID 1981–1982	BLS 1980, 1981	0.000108	Yes, significant	No	\$29,865	\$17.3
Viscusi and Moore (1989)	PSID 1982	NIOSH NTOF Survey, Structural Markov Model	0.0001	No	No	\$24,611	\$10.0
Herzog and Schlottman (1990)	U.S. Census 1970	BLS 1969	0.000097	No	No	\$48,364	\$11.7

(Continued on next page.)

THE VALUE OF A STATISTICAL LIFE

21

Table 2. (Continued).

Author (Year)	Sample	Risk variable	Mean risk	Nonfatal risk included?	Workers' comp included?	Average income level (2000 US\$)	Implicit VSL (millions, 2000 US\$)
Moore and Viscusi (1990b)	PSID 1982	NIOSH NTOF Survey, Structural Life Cycle Model	0.0001	No	No	\$24,611	\$20.8
Moore and Viscusi (1990c)	PSID 1982	NIOSH NTOF Survey, Structural Integrated Life Cycle Model	0.0001	Yes	Yes	\$24,611	\$20.8
Koinesner and Leeth (1991)	CPS 1978	NIOSH NTOF survey 1980–1985	0.0004	Yes, significant in some specifications	Yes	\$33,627	\$0.7
Gegax, Gerking, and Schulze (1991)	Authors' mail survey 1984	Workers' assessed fatality risk at work 1984	0.0009	No	No	\$41,391	\$2.1
Leigh (1991)	QES 1972–3, QES 1977, PSID 1974, 1981, Longitudinal QES 1973–1977, CPS January 1977	BLS 1979, workers' compensation data from 11 states 1977–1980	0.000134	No	No	\$32,961	\$7.1–\$15.3
Berger and Gabriel (1991)	US Census 1980	BLS 1979	0.00008–0.000097	No	No	\$46,865, \$48,029	\$8.6, \$10.9
Leigh (1995)	PSID 1981, CPS January 1977, QES 1977	BLS 1976, 79–81 and NIOSH 1980–85	0.00011–0.00013	No	No	\$29,587	\$8.1–\$16.8
Dorman and Hagstrom (1998)	PSID 1982	BLS 1979–1981, 1983, 1985, 1986; NIOSH NTOF 1980–1988	0.000123–0.0001639	Yes	Yes	\$32,243	\$8.7–\$20.3
Lott and Manning (2000)	CPS March 1971 and March 1985	Hickey-Kearney carcinogenic exposure 1972–1974, NIOSH National Occupational Exposure Survey 1981–1983	NA	No	No	\$30,245	\$1.5, \$3.0 (\$2.0, \$4.0) ¹

¹Lott and Manning (2000) estimate represents the value of avoiding a statistical fatal cancer case with an assumed latency period of 10 years (discounted at 3 percent). The reported values from their paper without discounting of this latency period are presented in parentheses.

over the last several decades, so have on-the-job mortality risks diverged. He notes that workplace safety is highly income-elastic. This result is related to the findings in Viscusi (1978b) that the value of a statistical life is increasing in worker wealth. Similarly, Viscusi and Evans (1990) have estimated the income elasticity of the value of statistical job injury risks to be 0.6 to 1.0. The effect of income on the wage-risk tradeoff is evident in a historical evaluation of employment risks as well. Kim and Fishback (1993) estimated compensating differentials for mortality risk in the railroad industry over the period 1893–1909 and found implicit values of statistical life on the order of \$150,000 in today's dollars.¹⁸ Our meta-analysis below examines the role of income differences in generating the variation in VSL estimates.

While most hedonic labor market studies focus on the risk of accidental death or accidental injury, several papers have attempted to explore the effect of occupational disease. Lott and Manning (2000) evaluated the effect of carcinogen exposure on workers' wages within the context of changing employer liability laws. In lieu of the standard mortality risk measures, the authors employ the Hickey and Kearney carcinogen index, which represents worker carcinogen exposure at the 2-digit SIC code level.¹⁹ They find that workers' wages reflect a risk premium for carcinogen exposure. Lott and Manning convert their results into a value of a statistical life assuming that the index is a proportional representation of the actual probability of getting occupational-related cancer, that 10–20 percent of all cancer deaths result from occupational exposures, and that the probability of a worker getting cancer ranges from 0.04 to 0.08 percent per year. We have modified their reported VSL range to account for a latency period.²⁰ Based on these assumptions, the authors estimate that the value of a statistical life based on occupational cancer would range from \$1.5–\$3.0 million. Assuming that occupational cancers, however, comprise a smaller fraction of all cancer deaths would increase the implicit VSL.²¹

Several early papers in the literature did not find statistically significant compensating differentials for on-the-job mortality risk. For example, Leigh (1981) estimated a risk premium for injuries but not for fatalities. Dorsey (1983) likewise did not find a mortality-based risk premium. The Leigh study coupled the Society of Actuaries mortality data with BLS injury data. The combination of greater measurement error in the data and the high correlation between injury risks and mortality risks probably led to the insignificance of the mortality risk variable. The Dorsey study uses industry-level averages, instead of worker-specific values, as its unit of observation. This averaging across industry for wages and related explanatory variables may have reduced the variation necessary to discern the effects of job-specific influences on wage, such as job risk.

More recent papers by Leigh (1995) and Dorman and Hagstrom (1998) also do not find compensating differentials in many model specifications. As discussed above, we do not find their inter-industry wage differential discussion compelling. Nevertheless, Table 2 includes their results based on the NIOSH data with industry dummy variables.²²

Some of these analyses of U.S. labor markets investigated the potential heterogeneity in the risk preferences of workers in the labor force in which there is worker sorting by level of risk. The empirical issue is whether the wage-risk tradeoff takes a linear or concave shape. A linear form would imply that an incremental increase of risk in the labor market requires a proportional increase in the wage differential. A concave form, however, would

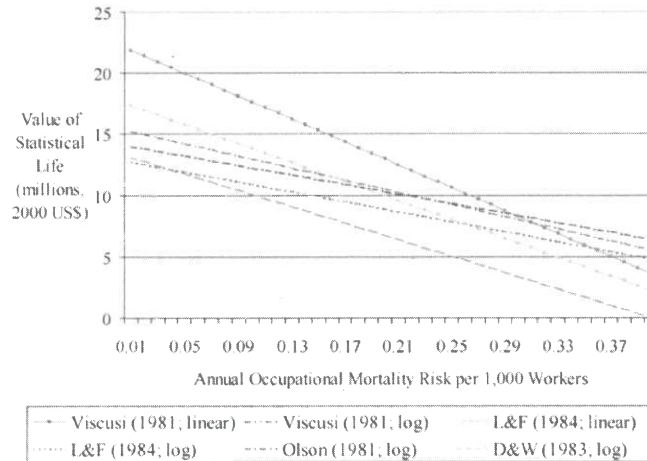


Figure 2. The value of a statistical life as a function of mortality risk.

imply a less than proportional increase in the wage differential, perhaps reflecting sorting by workers based on their risk preferences.

To evaluate the shape of this tradeoff, one can modify the wage equation regression model to include both mortality risk and the square of mortality risk. If the latter term is not significant, then the wage-risk tradeoff is linear for the range of risks and wages covered by the study's sample. If the squared term is significant and negative, then the wage-risk tradeoff takes a concave form. Viscusi (1981), Olson (1981), Dorsey and Walzer (1983), and Leigh and Folsom (1984) all found evidence that the risk-wage tradeoff curve is concave.²³ All four studies include regression models with a quadratic representation of mortality risk.

Figure 2 illustrates how the value of a statistical life varies with mortality risk for a sample of six regression models from these four papers. Viscusi (1981; linear) and Leigh and Folsom (1984; linear) represent regression models where the dependent variable is the hourly wage while the other four lines represent regression models with the logarithm of the wage as the dependent variable. All six models include measures of nonfatal injury risks (probability of a lost-workday accident and, in some cases, duration of lost-workday accident). The slopes of the risk-VSL lines in this figure are similar within the wage-specification type where the wage-based models appear to have a steeper tradeoff than do the logarithm of wage-based models (with the exception of the Dorsey and Walzer model, although this may reflect the fact that the sample in their study faced mortality risks 2 to 3 times smaller on average than the samples in the other studies). Based on these models, populations of individuals who select into jobs with very minor risks (e.g., on the order of 1 in 100,000) have implicit values of statistical life ranging from \$12 to \$22 million. Increasing the risk ten-fold, to levels that are close to the mean mortality risks in these studies, modestly reduces the VSL into the range of \$10 to \$18 million. Figure 2 illustrates that very high risks result in small values of statistical lives, although caution should be exercised when considering extrapolations beyond the samples' ranges.

3. Evidence of the value of a statistical life from U.S. housing and product markets

Housing and product market decisions also reflect individual tradeoffs between mortality risk and money. The main methodological difference is that economists typically estimate a hedonic price equation rather than a hedonic wage equation. The underlying theory is essentially the same, as comparison of Rosen (1974) with the wage equation analysis above will indicate.

Table 3 presents the results from eleven studies that evaluated the price-risk tradeoffs for seatbelt use, cigarette smoking, home fire detectors, automobile safety, bicycle helmets, and housing price responses to hazardous waste site risks.²⁴ The studies in general find an implicit value of a statistical life on the same order of magnitude as the labor market studies, although they tend to be a little lower.

The lower estimates may reflect several characteristics of these studies that distinguish them from the labor market studies. First, some product decisions do not provide a continuum of price-risk opportunities (unlike the labor market that does offer a fairly continuous array of wage-risk employment options) but rather a discrete safety decision. For example, Dardis' (1980) evaluation of smoke detectors represents such a discrete choice. In such a case, the consumer's decision to purchase a smoke detector reveals only the lower bound on the willingness to pay for the reduced risk. Similarly, the study by Jenkins, Owens, and Wiggins (2001) examines the purchase of bicycle helmets. It is interesting, however, that their results show VSLs increasing over the first half of the life cycle.

Second, the types of products considered in some studies may induce selection based on risk preferences. For example, the low estimated VSL for cigarette smokers found by Ippolito and Ippolito (1984) presumably reflects the non-random character of the smoking population. Their research focuses on cigarette smokers, and they estimate a VSL lower than from most product market studies. The lower VSL is consistent with the findings in Hersch and Viscusi (1990) and Viscusi and Hersch (2001) who find that individuals who engage in risky behaviors, such as cigarette smoking and driving without seatbelts, have lower implicit values for injury than do those who do not engage in such behavior.

Third, several studies are based on inferred, instead of observed, price-risk tradeoffs. Consider the seat belt, child seat, and motorcycle helmet studies by Blomquist (1979), Carlin and Sandy (1991) and Blomquist, Miller, and Levy (1996). In these studies, drivers', occupants', or riders' safety is traded off with the time to secure a seat belt or a child seat or to put on a helmet. The authors assume a given time cost—for example, Blomquist assumes that it takes 8 seconds to secure a seat belt. Then this time is monetized at the individual's wage rate (or a fraction thereof in Blomquist, 1979, and Blomquist, Miller and Levy, 1996). Unlike labor market studies where the monetary value of the attribute in question (job wage) is observed, these studies do not observe the actual time drivers take to buckle their seat belts. The amount of time is estimated separately. In addition to time costs, there are other aspects of seat belt or helmet use, such as the costs of discomfort of wearing a seatbelt or a helmet, which would increase the implicit valuation of a statistical life derived by this methodology. While some of these studies attempt to include estimates of these potentially large costs, the estimates are imprecise.

THE VALUE OF A STATISTICAL LIFE

25

Table 3. Summary of value of a statistical life studies based on tradeoffs outside the labor market, United States.

Author (Year)	Nature of risk, year	Component of the monetary tradeoff	Average income level (2000 US\$)	Implicit VSL (millions, 2000 US\$)
Blomquist (1979)	Automobile death risks, 1972	Estimated time costs and disutility of seat belts	\$38,395	\$1.0
Dardis (1980)	Fire fatality risks without smoke detectors, 1974–1979	Purchase price and maintenance costs of smoke detectors	NA	\$0.77
Portney (1981)	Mortality effects of air pollution, 1978	Property values in Allegheny County, PA	NA	\$1.03
Ippolito and Ippolito (1984)	Cigarette smoking risks, 1980	Monetary equivalent of effect of risk information	NA	\$0.90
Garbacz (1989)	Fire fatality risks without smoke detectors, 1968–1985	Purchase price of smoke detectors	NA	\$2.56
Atkinson and Halvorson (1990)	Automobile accident risks, 1989	Prices of new automobiles	NA	\$5.13
Carlin and Sandy (1991)	Fatality risks with use of children's car seats, 1985	Purchase price of car seats plus time to buckle children, 10 Indiana cities	\$24,737	\$0.84
Dreyfus and Viscusi (1995)	Automobile safety, 1988	Prices of automobiles	NA	\$3.8–\$5.4
Blomquist, Miller, and Levy (1996)	Fatality risks associated with use of safety-belts, children's car seats, and motorcycle helmets, 1985	Estimated time costs and disutility of safety devices	NA	\$1.7–\$9.9
Gayer, Hamilton, and Viscusi (2000)	Superfund sites' cancer risks, 1988–1993	Property values in Greater Grand Rapids, MI	NA	\$3.2–\$3.7 (\$4.3–\$5.0) [†]
Jenkins, Owens, and Wiggins (2001)	Bicycle-related fatal head injury risks, 1997	Purchase price of bicycle helmets	NA	\$1.4–\$2.9 (5–9 year olds) \$1.2–\$2.8 (10–14 year olds) \$2.1–\$4.3 (20–59 year olds)

[†]Gayer, Hamilton, and Viscusi (2000) estimate represents the value of avoiding a statistical cancer case with an assumed latency period of 10 years (discounted at 3 percent). The reported values from their paper without discounting of this latency period are presented in parentheses.

The studies focused on automobile purchases and home purchases do not suffer from the need to infer the monetary component of the price-risk tradeoff. For example, Atkinson and Halvorsen (1990) and Dreyfus and Viscusi (1995) evaluate the risk-price tradeoff for automobiles. They construct hedonic price models very similar to the hedonic wage models used in labor market analyses. Both studies include car purchase price (annual average for a given model) as the dependent variable and an array of automobile attributes as explanatory variables, such as vehicle size, power, reliability, fuel economy, and safety (fatal accident rate). Just as in the labor market hedonic studies, the coefficient on the safety variable in these automobile price hedonic studies reveals the price-risk tradeoff. Automobile purchases should be less likely to suffer the selection bias of the cigarette smoking study or the discreteness in decision of the fire alarm study.

Gayer, Hamilton, and Viscusi (2000) evaluate the tradeoff between housing prices and cancer risk associated with hazardous waste sites. The authors develop a housing hedonic price model, similar in form to the labor market hedonic studies. The dependent variable is the price of a house sold over a five-year period in the greater Grand Rapids, MI area, and explanatory variables include house characteristics such as number of bedrooms and bathrooms, neighborhood characteristics, property tax rates, measures of proximity to a Superfund hazardous waste site, and calculated cancer risk associated with exposure from the nearest hazardous site. The VSL interpretation from this study is analogous to that of Lott and Manning (2000). The hedonic price model generates the value of avoiding a statistical cancer case, which may not necessarily reflect the value of a statistical life to the extent that some cancers are treatable. If housing decisions are made based on the expectation that cancers associated with hazardous waste site exposure are terminal, then this price-risk tradeoff can be considered comparable to a VSL.²⁵

4. The value of a statistical life based on non-U.S. labor market studies

While about 25 wage-risk studies of the U.S. labor market were published in the 1970s and 1980s, only three studies on non-U.S. labor markets appeared in the literature during this period. We have identified another 20 labor market hedonic studies in both developed and developing countries outside of the U.S. context published since 1990. The studies presented in Table 4 include evaluations of wage-risk tradeoffs in labor markets in Australia, Austria, Canada, Japan, and the United Kingdom. More recent work in developing countries has focused on Asia, including analyses of labor markets in Hong Kong, India, South Korea, and Taiwan.

Marin and Psacharopoulos (1982) undertook the first hedonic labor market analysis of job risks outside of the United States in their study of the U.K. labor market. Based on wage and risk data from the 1970s, they found a value of a statistical life of about \$3.5 million. Arabsheibani and Marin (2000) sought to replicate the earlier Marin and Psacharopoulos analysis for the United Kingdom. By employing a similar methodology and more recent wage and risk data from the same sources as in the original study, the authors evaluated the stability of VSL estimates over time. They found, consistent with other studies of the U.K. labor market during the 1980s, a higher value of a statistical life than did Marin and Psacharopoulos. While the evaluation of the whole U.K. labor force yielded

THE VALUE OF A STATISTICAL LIFE

27

Table 4. Summary of labor market studies of the value of a statistical life, international.

Author (Year)	Country	Sample	Risk variable	Mean risk	Nonfatal risk included?	Workers' comp included?	Average income level (2000 US\$)	Implicit VSL (millions, 2000 US\$)
Marin and Psacharopoulos (1982)	UK	General Household Survey 1975	OPCS Occupational Mortality Decennial Survey 1970-72	0.0001	No	No	\$14,472	\$4.2
Weiss, Maier, and Gerking (1986)	Austria	Austrian Microcensus File of Central Bureau of Statistics 1981	Austrian Social Insurance Data on job-related accidents 1977-1984	NA	Yes	No	\$12,011	\$3.9, \$6.5
Meng (1989)	Canada	National Survey of Class Structure and Labour Process 1981	Labour Canada and Quebec Occupational Health and Safety Board 1981	0.00019	No	No	\$43,840	\$3.9-\$4.7
Meng and Smith (1990)	Canada	National Election Study 1984	Labour Canada and Quebec Occupational Health and Safety Board 1981-83	0.00012	No	No	\$29,646	\$6.5-\$10.3
Kniesner and Leeth (1991)	Japan	Two-digit manufacturing data 1986 (Japan)	Yearbook of Labor Statistics (Japan)	0.00003	Yes	No	\$44,863	\$9.7
Kniesner and Leeth (1991)	Australia	Two-digit manufacturing data 1984-85 (Australia, by state)	Industrial Accidents, Australia Bureau of Statistics 1984-1986	0.0001	Yes	Yes	\$23,307	\$4.2
Cousineau, Lacroix, and Girard (1992)	Canada	Labor, Canada Survey 1979	Quebec Compensation Board	0.00001	Yes	No	\$29,665	\$4.6
Martinello and Meng (1992)	Canada	Labour Market Activity Survey 1986	Labour Canada and Statistics Canada 1986	0.00025	Yes	No	\$25,387	\$2.2-\$6.8
Kim and Fishback (1993)	South Korea	Ministry of Labor's Report on Monthly Labor Survey and Survey on Basic Statistics for the Wage Structures	Ministry of Labor's Analysis for Industrial Accidents	0.000485	Yes	Yes	\$8,125	\$0.8
Siebert and Wei (1994)	UK	General Household Survey 1983	Health and Safety Executive (HSE) 1986-88	0.000038	Yes	No	\$12,810	\$9.4-\$11.5
Lanoie, Pedro, and Latour (1995)	Canada	Authors' in-person survey 1990	Quebec Workers' Compensation Board 1981-1985	0.000126	Yes	No	\$40,739	\$19.6-\$21.7

(Continued on next page.)

Table 4. (Continued).

Author (Year)	Country	Sample	Risk variable	Mean risk	Nonfatal risk included?	Workers' comp included?	Average income level (2000 US\$)	Implicit VSL (millions, 2000 US\$)
Sandy and Elliott (1996)	UK	Social Change and Economic Life Initiative Survey (SCELJ) 1986	OPCS Occupational Mortality Tables Decennial Supplement 1979/80–1982/3	0.000045	No	No	\$16,143	\$5.2–\$69.4
Shanmugam (1996/7)	India	Author's survey of blue collar manufacturing workers, Madras, India 1990	Administrative Report of Factories Act 1987–1990	0.000104	No	No	\$778	\$1.2, \$1.5
Liu, Hammitt, and Miller, Mulvey, and Norris (1997)	Taiwan	Taiwan Labor Force Survey 1982–1986	Taiwan Labor Insurance Agency 1982–1986	0.000225–0.000382	No	No	\$5,007–\$6,088	\$0.2–\$0.9
	Australia	Australian Census of Population and Housing 1991	Worksafe Australia, National Occupational Health and Safety Commission 1992–93	0.000068	No	No	\$27,177	\$11.3–\$19.1
Siebert and Wei (1998)	Hong Kong	Hong Kong Census 1991	Labour Department	0.000139	No	No	\$11,668	\$1.7
Liu and Hammitt (1999)	Taiwan	Authors' survey of petrochemical workers 1995	Workers' assessed fatality risk at work 1995	0.000513	Yes	No	\$18,483	\$0.7
Meng and Smith (1999)	Canada	Labour Market Activity Survey 1986	Ontario Workers' Compensation Board	0.00018	Yes	Yes	\$19,962	\$5.1–\$5.3
Arabsheibani and Marin (2000)	UK	General Household Survey (1980s)	OPCS Occupational Mortality Decennial Survey 1979–83	0.00005	Yes	No	\$20,163	\$19.9
Shanmugam (2000)	India	Author's survey of blue collar manufacturing workers, Madras, India 1990	Administrative Report of Factories Act 1987–1990	0.000104	Yes	No	\$778	\$1.0, \$1.4
Baranzini and Ferro Luzzi (2001)	Switzerland	Swiss Labour Force Survey, 1995, Swiss Wages Structure Survey, 1994	Swiss National Accident Insurance Company, 1991–1995	0.000059, 0.000064	No	No	\$47,400	\$6.3, \$8.6
Sandy et al. (2001)	UK	SCELJ 1986	OPCS 79/80–82/3, HSE 1986–88	0.000038, 0.000045	No	No	\$16,143	\$5.7, \$74.1
Shanmugam (2001)	India	Author's survey of blue collar manufacturing workers, Madras, India 1990	Administrative Report of Factories Act 1987–1990	0.000104	Yes	No	\$778	\$4.1

a relatively large VSL of about \$18 million, regression analyses of subsamples resulted in VSLs ranging up to \$68 million (in this case, for non-manual workers). While this result qualitatively conforms to the U.S. findings of lower VSLs for workers in higher risk jobs (see Figure 2), the magnitude of the U.K. compensating differentials seems implausibly large.

The results from several of the studies of the United Kingdom reveal compensating differentials on the order of 10 percent of total worker wage income. One regression result (with a VSL of \$69 million) from Sandy and Elliott (1996) implies a compensating differential for mortality risk comprising nearly 20 percent of worker wages. These risk premiums are substantially larger than the compensating differentials evident in other developed countries' labor markets, even those countries with higher per capita incomes. Moreover, risk levels cannot account for the high wage share of compensating differentials as the mortality risk is lower than in many U.S. studies. The large U.K. compensating differentials may reflect correlation between the risk measure and other unobservables that yield substantial returns to the worker.

After the United States, no country has been the focus of more hedonic labor market analyses of wage-risk tradeoffs than Canada. The Canadian studies appear to produce compensating differentials more in line with the U.S. experience than with the evidence from the U.K. labor market. With the exception of Lanoie, Pedro, and LaTour (1995), most Canadian labor market VSLs fall within the range of \$3–\$6 million. The Lanoie et al. findings of a VSL on the order of \$18 million–\$20 million may reflect their data collection methodology. They surveyed about 200 workers in the Montreal area and solicited workers' perceptions of risk with a risk information ladder similar to that in Gegax, Gerking, and Schulze (1991), which suffered from using a truncated job risk scale that omitted most job risks in the U.S. economy. Analyses by Lanoie et al. with industry risk measures provided by the Quebec Compensation Board did not yield statistically significant risk coefficients, while the perceived risk measures generated these large VSLs. This result contrasts with the findings of Cousineau, Lacroix, and Girard (1992) who found a statistically significant compensating differential for risk using mortality risk data from the same source on a sample of more than 30,000 Quebec workers.

With the exception of some U.K. studies, the compensating differentials estimated in developed country analyses tend to find risk premiums ranging between 1–2 percent of labor income. These results are broadly consistent with the findings in the Duncan and Holmlund (1983) paper that used Swedish workers' perceptions of danger in lieu of measured industry mortality risks. The authors estimated a statistically significant and positive compensating wage differential for dangerous jobs on the order of about 2 percent of wages. Swedish workers' perceptions of danger yield comparable compensating differentials to measured industry mortality risk in both U.S. and European studies (see Viscusi, 1979 for an example from the U.S. labor market).

Researchers have also evaluated the VSL in several of the newly industrialized countries of Asia, including Hong Kong, South Korea, and Taiwan. Note that these countries have on-the-job mortality risks three to five times greater than the average in Australia, the United States, and the United Kingdom. Further, the average worker earnings are two to four times lower than labor earnings in developed countries.

Kim and Fishback (1999) examined the South Korean labor market over the 1984–1990 period. Unlike many of the studies in developed countries, which employ worker-level data, their unit of observation is at the industry level. Kim and Fishback estimate a VSL of approximately \$0.5 million. They note that the estimated VSL is about 94 times the average annual earnings of workers. Siebert and Wei (1998) estimate a VSL for the Hong Kong workforce that is larger than the Korean estimate by about a factor of three. The ratio of VSL to average annual earnings for Hong Kong is about 150. These estimates are of the same order of magnitude as the ratio of VSL to annual earnings evident in the U.S. labor market.

Liu, Hammitt, and Liu (1997) and Liu and Hammitt (1999) estimated the wage-risk trade-off in Taiwan. The Liu, Hammitt, and Liu study focuses on all non-agricultural workers while Liu and Hammitt base their analysis on in-person surveys of petrochemical workers. In the former case, the authors use 3-digit industry level risk data, while the latter paper uses workers' risk perceptions derived from a survey instrument similar to that in Gegax, Gerking, and Schulze (1991). Workers' risk perceptions in the petrochemical industry yield a mortality risk rate about 35 percent greater than the rate published by the Taiwan Labor Insurance Agency, the data source for the Liu, Hammitt, and Liu study.²⁶ While petrochemical workers face higher average mortality risk (perceived and measured) than the average for all non-agricultural workers in Taiwan, the higher wages and income associated with petrochemical workers in 1995 relative to the broader workforce in the early to mid 1980s probably explains why Liu and Hammitt estimated a VSL about twice what Liu, Hammitt, and Liu found.

Estimates for the Indian labor market yield a value of a statistical life greater than the VSLs in other developing countries despite the fact that per capita income in India is an order of magnitude smaller than in these countries. Shanmugam (1996/1997, 1997, 2000, 2001) assessed the wage-risk tradeoff in a variety of studies using survey data of manufacturing workers in Madras, India in 1990. The VSL estimates from these studies range by nearly a factor of four, even though they reflect the same wage and risk data, illustrating how a variety of econometric specifications can produce in some cases a range of results.

5. The implicit value of a statistical injury: U.S. and international estimates

Complementing the research on the returns to bearing fatal risks in the workplace, a significant number of studies have evaluated the risk premium associated with bearing nonfatal job risks. The hedonic labor market studies of nonfatal risk employ the same econometric approach as used for mortality risk. As discussed above, some studies that attempt to estimate jointly the effects of fatal and nonfatal risks on workers' wages do not find significant effects of risk on wages for at least one of the risk measures. Fatal risk is highly correlated with nonfatal risk, so joint estimation may result in large standard errors due to collinearity. Omitting one of these variables when estimating the other could result in an upwardly biased estimate of the return to that type of risk.

Table 5 summarizes 31 studies from the U.S. labor market (Table 5(a)) and 8 studies of labor markets outside of the United States (Table 5(b)) that have found statistically significant influences of nonfatal job risk on wages. These studies employ three different

THE VALUE OF A STATISTICAL LIFE

31

Table 5(a). Summary of labor market studies of the value of statistical injury, United States.

Author (Year)	Sample	Risk variable	Mean injury risk	Fatal risk included?	Workers' comp included?	Average income level (2000 US\$)	Implicit value of a statistical injury (2000 US\$)
Smith (1974)	Current Population Survey (CPS) 1967, Census of Manufactures 1963, U.S. Census 1960, Employment and Earnings 1963	Bureau of Labor Statistics (BLS) 1966, 1967	NA	Yes, significant	No	\$29,029	-\$30,934
Smith (1976)	CPS 1967, 1973	BLS 1966, 1967, 1970	NA	Yes, significant	No	\$31,027	Nonfatal injury coefficient not significant
Viscusi (1978a, 1979)	Survey of Working Conditions, 1969-1970 (SWC)	BLS non-fatal injury rate 1969 (pre-OSHA)	0.032	Yes, significant	No	\$31,842	\$25,693-\$49,442
Viscusi (1978b)	SWC 1969-1970	BLS non-fatal injury rate 1969 (pre-OSHA)	0.032	No	No	\$32,675	\$61,537-\$63,241
McLean, Wendling, and Neergaard (1978)	Wisconsin Census 1970	Wisconsin Workers' Compensation accident data 1970	0.05	No	No	\$34,414	\$141,659
Viscusi (1981)	Panel Study of Income Dynamics (PSID) 1976	BLS non-fatal injury rate 1976	0.032	Yes, significant	No	\$22,618	\$59,238
Olson (1981)	CPS 1978	BLS total lost workday accident rate 1973	0.035	Yes, significant	No	\$36,151	\$24,009-\$32,304
Freeman and Medoff (1981)	CPS May 1973-1975	BLS mean lost workdays per worker 1972-1974	0.701	No	No	NA	Not reported—can't calculate (positive and statistically significant)
Leigh (1981)	PSID 1974, QES 1977	BLS injury rates 1974	NA	Yes, not significant	No	NA	Not reported—can't calculate (positive and statistically significant)
Butler (1983)	S.C. workers' compensation data 1940-69	S.C. workers' compensation claims data	.061 (claims rate)	No	Yes	\$22,713	\$936/day or \$16,848 for an 18-day injury
Dorsey and Walzer (1983)	CPS May 1978	BLS nonfatal lost workday injury incidence rate 1976	0.03	Yes, some specifications	Yes	\$21,636	\$60,581, \$69,235
Smith (1983)	CPS 1978	BLS Work Injury Rate	0.078	No	No	\$32,488	\$35,485

(Continued on next page.)

Table 5(a). (Continued).

Author (Year)	Sample	Risk variable	Mean injury risk	Fatal risk included?	Workers' comp included?	Average income level (2000 US\$)	Implicit value of a statistical injury (2000 US\$)
Dorsey (1983)	Employers' Expenditures for Employee Compensation survey 1977, BLS May 1978, BLS May 1979	BLS	0.036	Yes, not significant	Yes, in some specifications	\$33,019	\$102,360
Leigh and Folsom (1984)	PSID 1974; Quality of Employment Survey (QES) 1977	BLS nonfatal injury rate	0.074, 0.066	Yes	No	\$29,038, \$36,946	\$99,431–\$114,663
Viscusi and O'Connor (1984)	Authors chemical worker survey, 1982	Workers' assessed injury and illness rate	0.1	No	No	\$37,642	\$17,707–\$22,773
Dickens (1984)	CPS May 1977	BLS industry data 1977	NA	Yes	No	NA	Not reported—can't calculate
Viscusi and Moore (1987)	QES 1977	BLS lost workday injury rate, BLS total injury rate	0.038, 0.097	No	Yes	\$43,503	\$70,650 lost workday accident; \$27,950 for nonpecuniary loss—lost workday accident; \$45,400 per accident
Biddle and Zarkin (1988)	QES 1977	BLS nonfatal lost workday injury incident rate, 1977	0.037	No	No	\$42,170	\$168,603 (willingness to accept), \$155,582 (willingness to pay)
Garen (1988)	PSID 1981–1982	BLS nonfatal injury rate, 1980–1981	NA	Yes	No	\$29,865	\$26,953
Moore and Viscusi (1988b)	QES 1977	BLS annual incidence rate of lost workday cases 1973–1976	0.047	Yes, significant	Yes	\$31,092	\$36,818, \$48,349
Hersch and Viscusi (1990)	Authors' survey in Eugene, OR, 1987	Workers' assessed injury rate using BLS lost workday incidence rate scale	0.059	No	No (one state)	\$21,897	\$72,429 (whole sample); \$39,468 (smokers); \$118,277 (seat belt users)

(Continued on next page.)

THE VALUE OF A STATISTICAL LIFE

33

Table 5(a). (Continued).

Author (Year)	Sample	Risk variable	Mean injury risk	Fatal risk included?	Workers' comp included?	Average income level (2000 US\$)	Implicit value of a statistical injury (2000 US\$)
Viscusi and Evans (1990)	Viscusi and O'Connor chemical worker survey	Utility function estimates using assessed injury and illness rate	0.1	No	No	\$37,802	\$23,781 (marginal risk change); \$37,030 (certain injury)
Hamermesh and Wolfe (1990)	PSID 1981	BLS 1980, 1981	Incidence: 0.0476; Duration: 0.1571	No	Yes	NA	Not reported—can't calculate (positive and statistically significant)
Knaiesner and Leeth (1991)	CPS 1978	BLS lost workday injury rate	0.055	Yes	Yes	\$33,627	\$60,624
French and Kendall (1992)	CPS 1980 (railroad industry only)	Federal Railroad Administration Injury Rate	0.048	No	No	\$46,284	\$48,928
Fairris (1992)	SWC 1969–1970	BLS 1969 industry injury frequency rate	0.032	No	No	\$33,850	\$49,290
Hersch and Pickton (1995)	National Medical Expenditure Survey 1987	BLS total lost workdays per worker per year 1987	0.702 ¹	No	No	\$26,345	\$120,709 (whole sample); \$155,453 (nonsmoker-seat belt users); \$83,186 (smoker-nonsmoker belt users)
Dillingham, Miller, and Levy (1996)	QES 1977	Constructed risk measure	NA	Yes	No	\$24,267	\$155,435–\$242,671 WTP to avoid one year of worklife impairment
Dorman and Hagstrom (1998)	PSID 1982	BLS 1981	0.052	Yes	Yes	\$32,243	Nonfatal injury coefficient not significant
Hersch (1998)	CPS March 1994	BLS 1993 (number of cases of days away from work) females	0.029 whole sample; 0.022 females	No	No	\$28,004	\$22,810–\$33,723 (females); \$12,146–\$36,192 (males)
Viscusi and Hersch (2001)	National Medical Expenditure Survey 1987	BLS 1987 injury rate and lost workdays rate	Injury rate: 0.042 nonsmoker; 0.49 smoker	No	No	\$31,651 (nonsmokers); \$28,316 (smokers)	\$47,476–\$59,144 (nonsmokers); \$20,755–\$31,028 (smokers)

¹Note that the measure used in the Hersch and Pickton study—probability of losing 1 workday due to injury per worker per year—differs from the measure used in most other studies—probability of a lost workday injury per worker per year.

Table 5(b). Summary of labor market studies of the value of statistical injury, international.

Author (Year)	Country	Sample	Risk variable	Mean injury risk	Fatal risk included?	Workers' comp included?	Average income Level (2000 US\$)	Implicit value of a statistical injury (2000 US\$)
Cousineau, Lacroix, and Girard (1992)	Canada	Labor, Canada Survey 1979	Quebec Compensation Board	NA	Yes	No	\$29,665	\$38,104
Martinello and Meng (1992)	Canada	Labour Market Activity Survey 1986	Labour Canada and Statistics Canada 1986	0.063	Yes	No	\$25,387	\$10.815-\$14,456 for injury;
Siebert and Wei (1994)	UK	General Household Survey 1983	Health and Safety Executive (HSE) 1986-88 data	0.0143	Yes	No	\$12,810	\$161,210-\$191,027 for severe injury
Lanoie, Pedro, and Latour (1995)	Canada	Authors' in-person survey 1990	Quebec Workers' Compensation Board 1981-1985	0.099	Yes	No	\$40,739	Coefficient on injury risk not significant in all specifications
Liu and Hammitt (1999)	Taiwan	Authors' survey of petrochemical workers 1999	Workers' assessed injury risk at work 1995	0.0109	Yes	No	\$18,483	\$49,717
Meng and Smith (1999)	Canada	Labour Market Activity Survey 1986	Ontario Workers' Compensation Board	3.01-workdays lost per worker	Yes	Yes	\$19,962	\$423 per work day lost
Shannugam (2000)	India	Author's survey of blue collar manufacturing workers, Madras, India 1990	Administrative Report of Factories Act 1987-1990	0.0729	Yes	No	\$778	\$150-\$560
Shannugam (2001)	India	Author's survey of blue collar manufacturing workers, Madras, India 1990	Administrative Report of Factories Act 1987-1990	0.0729	Yes	No	\$778	\$350

measures of nonfatal job risks: the overall injury rate, the rate of injuries severe enough to result in a lost workday, and the rate of total lost workdays. Studies using different measures of nonfatal job risks will generate different risk premiums because the return to the frequency of injuries (the injury rate) will usually differ from the return to the severity of injuries (lost workdays rate). In two studies with specialized data, Butler (1983) constructed an injury rate from South Carolina workers' compensation claims, restricting his risk measure to only the more serious work accidents and French and Kendall (1992) and French (1990) constructed an injury rate for railroad workers based on data collected by the Federal Railroad Administration. As an alternative to these objective measures of risk, Viscusi and O'Connor (1984) and Hersch and Viscusi (1990) used workers' own assessments of risk with risk scales based on the BLS injury rate and the BLS lost workday accident rate, respectively. These authors estimated comparable wage-risk tradeoffs based on subjective risk perception as the other studies based on objectively measured industry-level risk.

These value of statistical injury studies yield a wide range of estimates, reflecting both the differences in the risk measures used as well as whether mortality risk is included in the results. While several studies have very high values of injury, such as McLean, Wendling, and Neergaard (1978), Leigh and Folsom (1984), and Biddle and Zarkin (1988), most studies have estimates in the range of \$20,000–\$70,000 per injury.

The value of statistical injury appears to vary with workers' preferences over risk, consistent with some of the findings based on the mortality risk literature. As a proxy for risk attitudes, several studies have used information about workers' behavior outside of the workplace, such as smoking status and seatbelt use, to identify the effect of risk preferences on wage-risk tradeoffs. Hersch and Viscusi (1990), Hersch and Pickton (1995), and Viscusi and Hersch (2001) all found that smokers have lower injury risk premiums than do non-smokers. Hersch and Viscusi as well as Hersch and Pickton also found that individuals who do not wear seatbelts have lower injury risk premiums than do individuals who regularly wear seatbelts.

The study by Hersch (1998) is of particular interest because it used gender-specific risk measures. Many previous studies had focused on male samples only because estimates using industry-based measures often failed to yield significant risk premiums for women. Researchers hypothesized that women did not work in risky jobs that would pose health and safety risks. The estimates by Hersch indicate that the nonfatal injury risk for women is over two-thirds the size of that for men and that the wage-injury risk tradeoff rates are similar for men and women.

The evidence outside of the United States, while based on a smaller set of studies, also indicates significant injury risk premiums. For example, the Cousineau, Lacroix, and Girard (1992) result falls within the U.S. range of about \$20,000–\$70,000. However, several other Canadian labor market studies provide some estimates that are lower, such as Martinello and Meng (1992) and Meng and Smith (1999). The value of statistical injury estimates for India are much smaller, likely reflecting the effect of per capita income on wage-risk tradeoffs. The low values of statistical injury are somewhat surprising given that these same studies generated fairly large values of statistical life.

6. The effects of income on the value of a statistical life

The review of the VSLs above shows that developing countries tend to have lower values of statistical life than do developed countries. A variety of factors could account for such an outcome, such as cultural influences on risk preferences and variations in labor market institutions. The dominant cause, however, is most likely that developing countries are poorer, and safety is a normal good, as shown in Viscusi (1978a). The value of a statistical life should increase with per capita income. To assess the relationship between the value of a statistical life and income, we first review several meta-analyses of the wage-risk literature. Second, we provide our estimates of the income elasticity of the value of a statistical life based on the meta-analysis approaches employed in four previous studies with a data set we constructed from our review of the papers presented in Tables 2 and 4. Third, we report income elasticities for a number of specifications in our preferred meta-analytic approach.

Since wage-risk studies employ a measure of income (usually a function of hourly or weekly labor earnings) as the dependent variable, an individual study cannot estimate the effect of income on the premium for bearing mortality risk. The injury risk study of Viscusi and Evans (1990) used experimental data coupled with market evidence to estimate income elasticities of injury risk valuations from 0.6 to 1.0. A meta-analysis of existing VSL studies can facilitate the calculation of the income elasticity for the value of a statistical life. The type of meta-analysis used in the VSL literature attempts to evaluate the VSL (the constructed dependent variable) as a function of a number of studies' characteristics (such as mean income of the sample population, mean mortality risk, and econometric specification).

The published meta-analyses on the value of a statistical life literature vary in terms of their sample construction, explanatory variables, and regression technique. Liu, Hammitt, and Liu (1997) sampled 17 wage-risk studies surveyed in Viscusi (1993) and regressed VSL on income and mean risk. The Liu et al. sample comprised primarily U.S. wage-risk studies. They reported a statistically insignificant income elasticity of 0.53. Miller (2000) developed an international sample including more than 60 wage-risk, product-risk, and contingent valuation studies. Miller employed a relatively small set of explanatory variables, including income. For five models, Miller estimated statistically significant income elasticities ranging from 0.85 to 0.96. Bowland and Beghin (2001) conducted a meta-analysis with a set of 33 wage-risk and contingent valuation studies surveyed in Viscusi (1993) and Desvousges et al. (1995). They matched the data on these studies with a variety of country-specific data on demographics, human capital, etc. Bowland and Beghin employed robust regression with Huber weights to address concerns about the non-normality in the residuals of their data. Bowland and Beghin reported statistically significant income elasticities of 1.7 and 2.3. In contrast to the previous three papers, Mrozek and Taylor (2002) constructed a sample of about 200 observations reflecting multiple VSL estimates from 33 wage-risk studies (eight of which evaluated non-U.S. labor markets). They employed the most extensive set of control variables, including those characterizing a study's sample, risk measure, specification, and earnings. For two models, Mrozek and Taylor impute statistically significant estimates of 0.46 and 0.49 for the income elasticity for the value of a statistical life.

To further explore the relationship between income and WTP, we have conducted a meta-analysis based on the U.S. and international VSLs reported in this paper. Our sample

includes the VSLs for 49 studies presented in Tables 2 and 4.²⁷ Each study yields one observation. Refer to the appendix for a description of the explanatory variables and their summary statistics.

We replicated the results from the four previous meta-analysis studies with our wage-risk study sample (see Table 6). For the Liu, Hammitt, and Liu (1997) model, we replicated their econometric specification exactly. Miller (2000) reported a number of specifications. Only model 3 of Miller's meta-analysis employed per capita incomes converted to US dollars on a purchasing power parity (PPP) basis. Because we constructed all VSLs and annual incomes based on a PPP basis, we replicated his model 3. Note that dummy variables for contingent valuation surveys and wage-risk studies are unnecessary since our data set comprises only wage-risk studies. Bowland and Beghin (2001) reported results for linear, log-linear, and trans-log specifications. While they presented very limited information about most of their control variables, we have attempted to replicate their set of controls. We do not have information on the average age of the sample used in the VSL studies, and we have omitted this variable from our specification. We have proxied for percent of sample in union-affiliated jobs by accounting for whether the VSL study includes union membership as a control and whether the VSL is union-based. Our studies do not provide average educational attainment, so we have proxied these values with national annual average educational attainment for the over-25 population from Barro and Lee (1996). We replicated the robust regressions with Huber weights. Our analyses with log-linear and trans-log specifications, however, yielded insignificant coefficients on income. We only present the results from the linear robust regression model with our data. Mrozek and Taylor (2002) reported results from four specification models. We have focused on their model 2 since model 1 yields virtually identical results and models 3 and 4 are U.S.-specific. We have included all the control variables that Mrozek and Taylor report, with the exception of a dummy variable for white collar-based VSLs. Our sample does not include any white collar-based VSLs.

Three of the four specifications yield statistically significant coefficients on the relevant income variable. We found a comparable point estimate with much narrower bounds than Liu et al. with their specification, perhaps reflecting our larger sample, as their sample is essentially a subset of our sample. We found a smaller coefficient on the income variable than Miller with his specification, although a very comparable coefficient on the Society of Actuaries risk data dummy variable (equivalent to Miller's variable label "risk beyond workplace" with our data). For comparison with Bowland and Beghin's choice of using "marginal willingness to pay" as their dependent variable (apparently equivalent to the VSL expressed in terms of hourly wage instead of annual labor income), we modified our dependent variable accordingly. Imputing the income elasticity with the linear income coefficient in this model requires the sample means of VSL (\$3,350 per hour worked, assuming 2000 hours worked per year and \$6.7 million VSL) and income (\$26,006). With 23 explanatory variables and only 41 observations, the Mrozek and Taylor specification yields very few precise coefficient estimates.

While the reported income elasticities from these four studies vary by a factor of 3, the imputed elasticity point estimates with our data set cover a much smaller range (see Table 7). With these studies' specifications, we found income elasticities from about 0.5 to 0.6. The 95 percent confidence interval upper bounds fall below 1.0 for two of the three statistically

Table 6. Replication of published meta-analyses with Viscusi-Aldy data.

Variable	Viscusi-Aldy Version of Liu et al. (1997) Eq. (2) (1)	Viscusi-Aldy Version of Miller (2000) Model 3 (2)	Viscusi-Aldy Version of Bowland- Beghin (2001) linear model (3)	Viscusi-Aldy Version of Mrozek-Taylor (2002) Model 2 (4)
Dependent variable	log (VSL)	log (VSL)	VSL (expressed in per hour terms)	log (VSL)
log(Income)	0.51* (0.15)	0.53* (0.17)	—	—
Income	—	—	0.078** (0.031)	—
Hourly wage	—	—	—	0.040 (0.026)
Mean risk	−0.015* (0.0057)	—	−19.34** (8.56)	−0.16*** (0.075)
Mean risk squared	—	—	—	0.0019 (0.0015)
Union × mean risk	—	—	—	0.22*** (0.11)
Dillingham risk	—	—	—	−0.32 (0.58)
Society of Actuaries risk	—	−1.29* (0.28)	—	—
BLS risk	—	—	1445.18** (591.47)	—
NIOSH risk	—	—	—	0.27 (0.40)
Education level	—	—	−157.14 (192.32)	—
Unemployment rate	—	—	—	0.045 (0.048)
U.S. national data	—	—	—	0.31 (0.82)
Non-U.S. study	—	—	—	−0.0048 (0.81)
Union VSL	—	—	2995.05* (1086.09)	−0.42 (0.90)
Union dummy variable	—	—	1000.76 (638.37)	0.43 (0.40)
Male only sample	—	—	−588.20 (600.82)	—

(Continued on next page.)

THE VALUE OF A STATISTICAL LIFE

39

Table 6. (Continued).

Variable	Viscusi-Aldy Version of Liu et al. (1997) Eq. (2) (1)	Viscusi-Aldy Version of Miller (2000) Model 3 (2)	Viscusi-Aldy Version of Bowland- Beghin (2001) linear model (3)	Viscusi-Aldy Version of Mrozek-Taylor (2002) Model 2 (4)
Dependent variable	log (VSL)	log (VSL)	VSL (expressed in per hour terms)	log (VSL)
Blue collar sample	—	—	—812.78 (644.54)	—0.68 (0.49)
Quadratic risk	—	—	—	0.54 (0.33)
Morbidity variable included	—	—	—	0.11 (0.32)
log(Dependent variable)	—	—	—	—0.24 (0.36)
Regional dummy variable	—	—	—757.70 (601.16)	0.16 (0.35)
Urban dummy variable	—	—	—65.91 (804.50)	0.12 (0.41)
Workers' compensation	—	—	—	0.10 (0.45)
Wage in after tax terms	—	—	—	—0.29 (0.50)
Industry dummy variable	—	—	—	0.081 (0.27)
Occupation dummy variable	—	—	—	0.0039 (0.20)
No occupation dummy variable	—	0.48 (0.33)	—	—
Job characteristics dummy variable	—	—	—	—0.021 (0.51)
Constant	10.56* (1.49)	9.80* (1.78)	1935.54 (1506.92)	15.68* (1.39)
R^2	0.37	0.27	—	0.83
n	46	49	45	41

Specifications (1), (2), and (4) estimated with ordinary least squares.

Specification (3) estimated with robust regression with Huber weights.

Robust (White) standard errors are presented in parentheses for specifications (1), (2), and (4).

Asymptotic standard errors presented in parentheses for specification (3).

*Indicates statistical significance at 1 percent level.

**Indicates statistical significance at 5 percent level.

***Indicates statistical significance at 10 percent level.

Table 7. Income elasticity of willingness-to-pay to reduce mortality risk.

Paper (Model)	Reported elasticity in authors' papers	Viscusi-Aldy version
Liu, Hammitt, and Liu (1997) (Eq. (2))	0.53	0.51* (0.21–0.80)
Miller (2000) (Model 3)	0.89*	0.53* (0.20–0.86)
Mrozek and Taylor (2002) (Model 2)	0.46**	0.52 (–0.18–1.22)
Bowland and Beghin (2001) (linear model)	1.66*	0.61** (0.11–1.10)

Ranges in parentheses represent the 95 percent confidence interval around the point estimate for the income elasticity.

*Indicates elasticity is based on coefficient that is statistically significant at 1 percent level.

**Indicates elasticity is based on coefficient that is statistically significant at 5 percent level.

significant income elasticities estimated by the specifications outlined in these four studies. The apparently large variation in income elasticities in this literature apparently reflects authors' choices of studies for inclusion more so than choices over control variables and regression techniques.

To augment the replications of previously published meta-analysis specifications, we evaluated a large number of specifications. Based on the existing literature, we focused on two regression techniques, ordinary least squares and robust regression with Huber weights. We have varied the control variables from as few as 3 to as many as 18, recognizing that coefficient estimates' precision will decline with the length of the right-hand side of the regression equations given our sample size. We chose to include explanatory variables of the following types: income and mean risk (common to all specifications), type of risk measure, and specification variables.

The estimated coefficient on the income variable is rather stable across both regression techniques and for a wide variation in the number of control variables (see Table 8). For the OLS specifications, the income elasticity varies from 0.49 to 0.60. The 95 percent confidence intervals never range below 0.2 and never exceed 0.95. For the robust regression specifications, the income elasticity varies from 0.46 to 0.48. The 95 percent confidence intervals never fall below 0.15 and never exceed 0.78.²⁸ The income coefficients in all specifications are statistically significant at the 1 percent level.

Based on the approximately 50 wage-risk studies from 10 countries, we can conclude from these results that the income elasticity for the value of a statistical life is less than 1.0. Across a number of specifications with our data, our point estimates of the income elasticity range between about 0.5 and 0.6. Note that in none of our specifications did the income elasticity's 95 percent confidence interval upper bound exceed 1.0.

Current practice by regulatory agencies is effectively in line with these findings. The U.S. EPA (1999) accounted for income growth into the 22nd century in monetizing the long-term mortality risk reduction benefits from stratospheric ozone protection.²⁹ In a regulatory context, the U.S. EPA (2000b) also accounted for income growth over a thirty-year period in monetizing the mortality risk reduction benefits from reduced particulate matter pollution

Table 8. Regression models for Viscusi-Aldy meta-analysis.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Regression technique	OLS	OLS	OLS	Robust with Huber weights	Robust with Huber weights	Robust with Huber weights
log(Income)	0.51* (0.15)	0.49* (0.13)	0.60* (0.16)	0.48* (0.12)	0.46* (0.11)	0.47* (0.15)
Mean risk	-0.015** (0.0057)	-0.053* (0.011)	-0.045* (0.015)	-0.029* (0.0061)	-0.090* (0.018)	-0.11* (0.029)
Mean risk squared	-	0.00022* (0.000052)	0.00016* (0.000055)	-	0.00065* (0.00019)	0.0010** (0.00035)
Society of Actuaries risk	-	-	0.50 (0.87)	-	-	Dropped
NIOSH risk	-	-	0.50 (0.41)	-	-	0.56 (0.41)
Subjective	-	-	-0.69 (0.78)	-	-	-0.16 (0.98)
Union dummy variable	-	-	0.44 (0.32)	-	-	0.50 (0.30)
Male only sample	-	-	0.24 (0.36)	-	-	0.36 (0.34)
Blue collar sample	-	-	-0.016 (0.31)	-	-	-0.23 (0.33)
Quadratic risk	-	-	0.092 (0.27)	-	-	0.20 (0.34)
Morbidity variable included	-	-	0.55*** (0.30)	-	-	0.62** (0.30)
log(Dependent variable)	-	-	0.17 (0.31)	-	-	0.13 (0.41)
Regional dummy variable	-	-	-0.16 (0.25)	-	-	0.16 (0.31)
Urban dummy variable	-	-	0.38 (0.29)	-	-	0.087 (0.39)
Workers' compensation	-	-	-0.57 (0.33)	-	-	-0.28 (0.38)
Industry dummy variable	-	-	-0.46 (0.27)	-	-	-0.37 (0.28)
Occupation dummy variable	-	-	-0.45 (0.31)	-	-	-0.24 (0.33)
Constant	10.56* (1.49)	11.22* (1.30)	9.58* (1.82)	11.05* (1.23)	11.83* (1.12)	11.22* (1.68)
R ²	0.37	0.55	0.72	-	-	-

(Continued on next page.)

Table 8. (Continued).

Regression technique	OLS	OLS	OLS	Robust with Huber weights	Robust with Huber weights	Robust with Huber weights
<i>n</i>	46	46	46	45	45	44
Income elasticity (95% confidence interval)	0.51 (0.21–0.80)	0.49 (0.23–0.75)	0.60 (0.27–0.94)	0.48 (0.23–0.73)	0.46 (0.24–0.69)	0.47 (0.15–0.78)
Mean predicted VSL, full sample (millions 2000 US\$) (95% confidence interval)	5.0 (3.4–7.4)	5.4 (3.7–7.8)	5.9 (2.7–13.9)	5.5 (4.1–7.5)	5.9 (4.4–8.1)	6.2 (2.5–15.7)
Mean predicted VSL, U.S. sample (millions 2000 US\$) (95% confidence interval)	5.5 (3.8–8.1)	5.8 (4.1–8.3)	6.9 (3.1–16.2)	6.1 (4.6–8.2)	6.3 (4.8–8.4)	7.6 (3.0–19.4)

Dependent variable: $\log(\text{VSL})$.

Robust (White) standard errors presented in parentheses for specifications 1–3.

Asymptotic standard errors presented in parentheses for specifications 4–6.

*Indicates statistical significance at 1 percent level.

**Indicates statistical significance at 5 percent level.

***Indicates statistical significance at 10 percent level.

Note: Estimation with robust standard errors clustered by wage data source yields same significance levels, with the exception of Mean Risk in (1) and (3) and Mean Risk Squared in (3), which are all significant at the 2 percent level, and the industry dummy variable in (3) which is significant at the 8 percent level.

associated with the diesel sulfur standard for heavy-duty trucks. In both these cases, the U.S. EPA employed an income elasticity of 0.4 and conducted sensitivity analyses with a low-end elasticity of 0.1 and a high-end elasticity of 1.0. If our results for the income elasticity apply over time, the point estimate chosen by the EPA is reasonable, although more narrow bounds may be appropriate for the sensitivity analysis.

The meta-analysis regressions can also serve to characterize some of the uncertainty in value of a statistical life estimates. We constructed the mean predicted VSL values presented in the last two rows of Table 8 by first using the estimated coefficients from the meta-analysis regressions to predict the natural logarithm of VSL for each study. Then we converted each predicted $\log(\text{VSL})$ to a predicted VSL. We averaged these over all studies that were included in each regression model's sample to produce the average values reported in the table. We constructed the average 95 percent confidence intervals by first estimating the prediction error for each study from the meta-analysis regressions. We then used this prediction error to construct study-specific 95 percent confidence intervals. The values for the lower and upper bounds of these confidence intervals were then averaged over all the studies in the regression sample. The U.S. specific results are based on regression samples that include non-U.S. studies; only the averaging is U.S.-specific.³⁰

The mean predicted VSLs from the meta-analysis regression models for the whole sample vary from \$5.0 to \$6.2 million, and from \$5.5 to \$7.6 million for the U.S. sample. An assessment of median predicted VSLs produced very similar results. For most regression models, the 95 percent confidence interval upper bound is double or more than the 95 percent

confidence interval lower bound. Note that the small number of degrees of freedom in specifications 3 and 6 yielded very large bounds around the measure of central tendency. While this analysis can characterize some of the uncertainty around the value of a statistical life, several caveats are in order. First, the description of uncertainty presumes that the proper VSL meta-analysis model has been specified. Otherwise, the bounds around the predicted means are not valid. Second, this assessment of uncertainty regards the value of a statistical life constructed from a sample of wage-risk studies of prime-aged workers. Policy applications of these VSLs in benefits transfer should consider appropriate modifications to the VSL point estimate *and* the distribution around it.

7. The effects of union affiliation on the value of a statistical life

Since the U.S. and international evidence from labor markets and other product markets demonstrate a significant wage-risk tradeoff, numerous researchers have explored several factors that may influence the compensating differential for risk. The relationship between union affiliation and the wage-risk tradeoff has received substantial attention in the literature. Most studies of the U.S. labor market find that union affiliation is positively correlated with a greater wage-risk tradeoff while the international evidence is much more mixed.

Workers in union jobs may enjoy an additional premium for bearing risk greater than those in nonunion jobs for several reasons. First, if firms face an upward sloping labor supply curve, then the absence of collective bargaining may result in an inefficiently low level of workplace safety. Viscusi (1980) shows that if the marginal worker's valuation of workplace safety differs from the average worker's valuation, then the firm would provide a suboptimal level of safety. If the marginal worker is willing to accept less of a decrease in wage for an incremental improvement in safety than the average worker, then workplace safety would be too low. If the marginal worker tends to be younger and less experienced while the average worker tends to be older and wealthier, then the average worker with greater wealth and family obligations may have a greater preference for workplace safety than the marginal worker. In light of this inefficiently low provision of safety, unions may bargain over workplace safety in addition to wages and other benefits on behalf of the inframarginal workers who may place greater value on risk reduction than the marginal worker.

A second, and not entirely unrelated phenomenon, is that workplace safety may be a quasi-public good and suffer the common under-provision associated with such goods due to free-riding (Dillingham and Smith, 1984). If a firm provides some level of workplace safety (e.g., a fire extinguishing system), then one worker's consumption of this safety does not preclude another worker from enjoying the same consumption. Since safety is quasi-public, a worker lacks the incentive to truthfully reveal his or her preference for safety, especially since an increase in safety would likely correspond to a decline in the wage (or some other benefit). Collective action can overcome such free-riding. In this case, collective bargaining by a union with a firm could reflect all workers' true preferences for safety, and result in higher aggregate demand for safety by workers than what would be expected in a non-union setting. This higher demand would translate into greater compensating differentials for job-related injury and fatality risk.

Third, if some workers lack adequate information about the safety at their workplace, then they may underestimate the actual risks they face. Workers underestimating their on-the-job risk would demand lower wages than if they held correct perceptions of risk. Unions potentially could provide workers with more accurate information about their on-the-job risks (Viscusi, 1979; Olson, 1981). Unions can take advantage of economies of scale in providing information not available to unorganized non-union workers (Dillingham and Smith, 1984). Unions may also negotiate for mechanisms that increase worker exposure to safety information. For example, Olson noted that a 1976 BLS survey showed that 36 percent of all workers covered by a collective bargaining agreement worked in establishments that sponsored joint firm-worker safety committees.

To evaluate the extent to which these factors influence compensating differentials for on-the-job risk, researchers have taken two estimation approaches (see Table 9). First, some have split their samples into union and non-union subsamples and estimated the wage regressions separately for each subsample. Second, others have included an interaction term, risk variable \times union dummy variable, in the wage regression model. In our review of papers evaluating union effects, only Olson (1981) assessed the union-risk premium with both the separate sample regression approach and the risk-union interaction approach. Both approaches yield substantial differences in compensating differentials for union and non-union members.

Regardless of estimation strategy, most assessments of the U.S. labor market found higher risk premiums for union workers than for non-union workers (see Table 9(a)). Of the ten U.S. labor market value of life studies we reviewed that evaluated the role of unions in risk premiums, nine found union workers enjoyed greater compensating differentials for bearing risk than nonunion workers. In contrast to accepted theory, several of these papers found that non-union workers had insignificant or statistically significant *negative* compensating differentials for risk.³¹

Table 9(b) summarizes the rather mixed effects of unionization on premiums for nonfatal risks in the U.S. labor market. In the studies that controlled for fatal risks, the compensating differential for injury risk for nonunion workers often exceeded the differential for union workers, even in the same studies where the union fatality risk premium was greater (e.g., Olson, 1981; Dorsey, 1983; Dorsey and Walzer, 1984). Olson found that union workers enjoyed a greater positive premium than nonunion workers for injury incidence but a negative premium for injury duration (number of lost workdays), in contrast to nonunion workers' positive premium.

In regressions that did not include a variable for fatality risk in the estimation model, the findings reflected the results for fatality risk discussed above. Hamermesh and Wolfe (1990) found that the extra compensating differential for union workers reflected injury incidence, while injury duration was insignificant, similar to Olson. While Freeman and Medoff (1981) could not discern between the statistically significant injury risk premiums for union and non-union workers, Smith (1983), Biddle and Zarkin (1988), Fairris (1992), and Hersch and Pickton (1995) all found greater compensating differentials for nonfatal risks for union than for nonunion workers.

While the majority of the U.S. research illustrates greater risk premiums for union workers, the research on labor markets in other countries often reveals a more ambiguous union

THE VALUE OF A STATISTICAL LIFE

45

Table 9(a). Summary of union effects in value of a statistical life studies, United States.

Author (Year)	Sample	Risk variable	Mean risk	Nonfatal risk included?	Workers' comp included?	Average income level (2000 US\$)	Union implicit VSL (millions, 2000 US\$)	Nonunion implicit VSL (millions, 2000 US\$)	Specification of union status
Thaler and Rosen (1975)	Survey of Economic Opportunity	Society of Actuaries 1967	0.001	No	No	\$34,663	\$1.7-\$1.9	Negative	Risk \times union interaction
Viscusi (1980)	SWC 1969-1970	BLS 3-digit industry data for 1969	0.00018	Yes	No	\$31,842	\$5.5-\$15.2	Not significant	Risk \times union interaction
Olson (1981)	CPS 1978	BLS 1973	0.0001	Yes, significant	No	\$36,151	\$30.6-\$44.2	\$5.7-\$5.8	Risk \times union interaction and separate regressions by union status
Dorsey (1983)	Employers' Expenditures for Employee Compensation survey 1977, BLS May 1978, BLS May 1979	BLS	0.000071	Yes, significant	Yes, in some specifications	\$33,019	\$9.6	Negative	Risk \times union interaction
Dorsey and Walzer (1983)	CPS May 1978	BLS 1976	0.000052	Yes, significant	Yes	\$21,636	\$11.8, \$12.3	Negative	Separate regressions by union status
Dillingham and Smith (1984)	CPS May 1979	BLS industry data 1976, 1979; NY Workers' Comp Data 1970	0.000082	Yes, significant in some specifications	No	\$29,707	\$6.1, \$6.6	\$3.1	Separate regressions by union status
Garen (1988)	PSID 1981-1982	BLS 1980, 1981	0.000108	Yes, significant	No	\$29,865	Insufficient information provided to calculate	Positive, but smaller than union VSL	Risk \times union interaction
Gegax, Gerking, and Schultze (1991)	Authors' mail survey 1984	Workers' assessed fatality risk at work 1984	0.0009	No	No	\$41,391	\$2.7	Not significant	Separate regressions by union status
Kim and Fishback (1993)	Interstate Commerce Commission data 1893-1909, 1926-32, 1934-45	ICC Fatality Data 1890-1945	0.0006-0.0018	Yes	No	NA	No statistical difference between union and nonunion members		Risk \times union interaction
Dorman and Hagstrom (1998)	PSID 1982	BLS 1979-1981, 1983, 1985, 1986; NIOSH NTOF 1980-1988	0.000123-0.0001639	Yes	Yes	\$32,243	\$18.1	\$8.7	Risk \times union interaction

Table 9(b). Summary of union effects in value of statistical injury studies, United States.

Author (Year)	Sample	Risk variable	Mean risk	Fatal risk included?	Workers' comp included?	Average income level (2000 US\$)	Union implicit value of a injury (2000 US\$)	Nonunion implicit value statistical of a injury (2000 US\$)	Specification of union status
Biddle and Zarkin (1988)	QES 1977	BLS nonfatal lost workday injury incident rate, 1977	0.037	No	No	\$42,170	\$319,678	\$56,832	Risk \times union interaction
Freeman and Medoff (1981)	CPS May 1973-1975	BLS mean lost workdays per worker 1972-1974	0.701*	No	No	NA	No statistical difference between union and nonunion members		Separate regressions by union status
Smith (1983)	CPS 1978	BLS work injury rate	0.078	No	No	\$38,138 (males); \$25,672 (females)	\$74,368 (males); \$59,815 (females)	\$46,528 (males); \$25,672 (females)	Risk \times union interaction
Fairris (1992)	SWC 1969-1970	BLS 1969 industry injury frequency rate	0.032	No	No	\$33,850	\$246,449	Not significant	Separate regressions by union status
Hamermesh and Wolfe (1990)	PSID 1981	BLS 1980, 1981	Incidence: 0.0476; Duration: 0.1571	No	Yes	NA	Insufficient information provided to calculate	Positive, but smaller than union value of injury	Risk \times union interaction
Hersch and Pickton (1995)	National Medical Expenditure Survey 1987	BLS total lost workdays per worker per year 1987	0.702*	No	No	\$26,345	\$222,448	\$99,478	Risk \times union interaction

*Lost workdays per 100 full-time workers.

THE VALUE OF A STATISTICAL LIFE

47

Table 9(c). Summary of union effects in value of a statistical life studies, international.

Author (Year)	Country	Sample	Risk variable	Mean risk	Nonfatal risk included?	Workers' comp included?	Average income level (2000 US\$)	Union implicit VSL (millions, 2000 US\$)	Nonunion implicit VSL (millions, 2000 US\$)	Specification of union status
Marin and Psacharopoulos (1982)	UK	General Household Survey 1975	OPCS Occupational Mortality Decennial Survey 1970-72	0.0001	No	No	\$14,472	No statistical difference between union and nonunion members		Risk × union interaction
Meng (1989)	Canada	National Survey of Class Structure and Labour Process 1981	Labour Canada and Quebec Occupational Health and Safety Board 1981	0.00019	No	No	\$43,840	No statistical difference between union and nonunion members		Risk × union interaction
Meng and Smith (1990)	Canada	National Election Study 1984	Labour Canada and Quebec Occupational Health and Safety Board 1981-83	0.00012	No	No	\$29,646	No statistical difference between union and nonunion members		Risk × union interaction
Meng (1991)	Canada	Labour Market Activity Survey 1986	Labour Canada and Workers' Compensation Boards	0.00023 for accidents, 0.00012 for disease	No	No	\$25,387	\$1.9	\$4.2	Risk × union interaction

(Continued on next page.)

Table 9(c). (Continued.)

Author (Year)	Country	Sample	Risk variable	Mean risk	Nonfatal risk included?	Workers' comp included?	Average income level (2000 US\$)	Union implicit VSL (millions, 2000 US\$)	Nonunion implicit VSL (millions, 2000 US\$)	Specification of union status
Cousineau, Lacroix, and Girard (1992)	Canada	Labour Canada Survey 1979	Quebec Compensation Board	0.00001	Yes	No	\$29,665	\$4.4	\$2.0	Separate regressions by union status
Martinello and Meng (1992)	Canada	Labour Market Activity Survey 1986	Labour Canada and Statistics Canada 1986	0.00025	Yes	No	\$25,387	No statistical difference between union and nonunion members		Risk \times union interaction
Siebert and Wei (1994)	UK	General Household Survey 1983	Health and Safety Executive (HSE) 1986-88	0.0000379	Yes	No	\$12,810	\$11.5	\$9.4	Separate regressions by union status
Lanoie, Pedro, and Latour (1995)	Canada	Authors' in-person survey 1990	Quebec Workers' Compensation Board 1981-1985	0.000126	Yes	No	\$40,739	\$19.6, \$21.7	Not significant	Separate regression equations
Sandy and Elliott (1996)	UK	Social Change and Economic Life Initiative Survey (SCEL) 1986	OPCS Occupational Mortality Tables Decennial Supplement 1979/80-1982/3	4.4831E-05	No	No	\$16,143	\$69.0	\$69.4	Risk \times union interaction

(Continued on next page.)

THE VALUE OF A STATISTICAL LIFE

49

Table 9(c). (Continued.)

Author (Year)	Country	Sample	Risk variable	Mean risk	Nonfatal risk included?	Workers' comp included?	Average income level (2000 US\$)	Union implicit VSL (millions, 2000 US\$)	Nonunion implicit VSL (millions, 2000 US\$)	Specification of union status
Shanmugam (1996)	India	Author's survey of blue collar manufacturing workers, Madras, India 1990	Administrative Report of Factories Act 1987-1990	0.000104	No	No	\$778	\$0.6	Not significant	Risk \times union interaction
Kim and Fishback (1999)	South Korea	Ministry of Labor's Report on Monthly Labor Survey and Survey on Basic Statistics for the Wage Structures	Ministry of Labor's Analysis for Industrial Accidents	0.000485	Yes	Yes	\$8,125	No statistical difference between union and nonunion members		Risk \times union interaction
Arabsheibani and Marin (2000)	UK	General Household Survey (1980s)	OPCS Occupational Mortality Decennial Survey 1979-83	Reported as -0.006	Yes	No	\$20,163	No statistical difference between union and nonunion members		Risk \times union interaction
Baranzini and Ferro Luzzi (2001)	Switzerland	Swiss Labour Force Survey, 1995, Swiss Wages Structure Survey, 1994	Swiss National Accident Insurance Company, 1991-1995	0.000059, 0.000064	No	No	\$47,400	No statistical difference between union and nonunion members		Separate regressions by union status
Sandy et al. (2001)	UK	SCELI 1986	OPCS 79/80-82/3, HSE 1986-88	0.000038, 0.000045	No	No	\$16,143	\$5.7, \$44.8	\$36.1, \$74.1	Risk \times union interaction

impact on risk premiums (Table 9(c)). Marin and Psacharopoulos (1982) conducted the first analysis of compensating differentials for risk in the U.K. labor market, and found that union affiliation had an insignificant impact on the risk premium. In an attempt to replicate this initial study, Arabsheibani and Marin (2000) also could not find any evidence supporting a union-risk premium based on membership or union strength. In contrast, Siebert and Wei (1994) found higher union risk premiums when accounting for potential endogeneity of risk. Subsequent research by Sandy and Elliott (1996) countered this finding with analysis indicating larger compensating differentials for risk for nonunion members. These four researchers collaborated in a follow-up study, Sandy et al. (2001), which concluded with a qualified claim that nonunion workers enjoy greater risk premiums.

For the Canadian labor market, several analyses have found little support for a positive impact of union affiliation on compensating differentials for risk. In a series of analyses with union \times fatality risk interaction terms, Meng (1989, 1991) and Martinello and Meng (1992) found no significant effect for accident risk, while Meng and Smith (1990) found a negative statistically significant coefficient that when combined with the fatality risk coefficient would translate into no compensating differential for union members (in contrast to the positive risk premium for non-union members). In contrast, Cousineau, Lacroix, and Girard (1992) found for a large Quebec sample that union members received larger premiums for both fatality risk and injury incidence, but a smaller premium for injury duration, than nonunion members. Further, Lanoie, Pedro, and Latour (1995) found significant positive compensating differentials for perceived risk for the union sub-sample from their survey of Montreal work establishments.

Finally, the few analyses of developing country labor markets have also found mixed effects of union affiliation on a worker's risk premium. In his analysis of the Indian labor market, Shanmugam (1996/7) included a union \times fatality risk interaction term, and found that union members alone enjoy a compensating differential for risk. For the South Korean labor market, Kim and Fishback (1999) could not statistically discern compensating differentials for risk between union and non-union workers.

8. The effects of age on the value of a statistical life

Evaluating wage-risk tradeoffs in labor markets to estimate the value of a statistical life raises the important question of whether life expectancy affects the value of a statistical life. Age affects the duration of life at risk and also may be correlated with other variables that affect one's willingness to bear risk, which are not age effects per se but rather reflect changing preferences over the life cycle. Numerous analyses have shown that the magnitude of the VSL is a decreasing function of age, whereas the value of any particular year of life may increase with age (Rosen, 1988).³² Wholly apart from life expectancy effects, accounting for the effect of age in the utility function in terms of deteriorating health and quality of life would have generated similar results.³³

Using this framework, Rosen undertook several simulations based on his previous empirical work (Thaler and Rosen, 1975). He estimated that the value of a statistical life-year, which is equal to the expected consumer surplus for another year, for the average-aged individual in the sample ranges from about \$31,000 to \$130,000, based on discount rates

ranging from 0 to 12 percent. Using data on life expectancy by age, Rosen calculated the value of a statistical life for comparable individuals who varied from 36 years to 48 years of age. The 48-year old's VSL is 10 percent less than the 36-year old's VSL.

Several researchers have undertaken direct empirical estimates of the effect of age on the return to risk in hedonic labor market analysis. A simple approach to estimating the effect requires interacting the mortality risk and age variables in the regression model. While some researchers did not identify significant coefficients to this interaction (Meng and Smith, 1990; Shanmugam, 1996/7, 2001), several others found statistically significant and negative estimates broadly consistent with the theory (see Table 10). Research by Thaler and Rosen (1975), Viscusi (1979), Arnould and Nichols (1983) and Moore and Viscusi (1988b) yielded the negative relationship between age and the return to risk. Within the context of a local housing market, Portney (1981) found that the value of a statistical life based on trading off mortality risk associated with local air pollution exposure and housing prices declines significantly with age: an individual under the age of 45 has a VSL 20 times greater than an individual over the age of 65.

Dillingham, Miller, and Levy (1996) employed a modified approach by focusing on the willingness to pay to avoid a fully impaired worklife, where death is the extreme case of impairment. The authors construct a risk variable that reflects injury frequency, severity, and probability of fatality. They assume that a worklife shortened by a fatal injury is equivalent to a worklife shortened by a permanently disabling injury. Their "value of remaining worklife" ranges from \$3.1–\$4.7 million for the whole sample, although it decreases with age. For example, they estimate that a 50-year old values remaining worklife at half the value held by a 30-year old.

Some researchers have proposed a value per discounted expected life-year approach (Moore and Viscusi, 1988b). In lieu of a value of a statistical life, one could adjust the VSL measure for the life expectancy of individuals by essentially annuitizing the estimated VSL. Based on actuarial tables, one could estimate the life expectancy for the average-aged individual in a study and then develop estimates of the life-year value (either by assuming a discount rate, or as in several studies, estimating a discount rate based on revealed preference procedures—see below). Then this life-year could be applied to other situations where life expectancy would differ from the average in the study in question. This approach provides an "age-adjusted" or "life expectancy-adjusted" VSL alternative to the standard VSL. While the life-year approach does address the concern that values of a statistical life should vary with life expectancy, they assume that the marginal value of another year is constant across the age spectrum and across time for a given individual.³⁴

Accounting for the effects of age on the value of a statistical life through a life-year approach requires the discounting of future consumer surplus (since, on the margin, the compensating differential should equal the present discounted value of a worker's expected consumer surplus). A variety of papers have imputed workers' or consumers' implicit rates of discount (Moore and Viscusi, 1988b, 1990a, 1990b, 1990c; Viscusi and Moore, 1989; Dreyfus and Viscusi, 1995).³⁵ While the Moore and Viscusi (1988b) and Dreyfus and Viscusi papers estimate implicit discount rates and marginal discounted life-years based on reduced form models, the other three papers develop structural models to estimate discount rates. Also note that all of these models are based on data from labor markets, except for

Table 10. Summary of age-risk interaction effects in value of a statistical life studies.

Author (Year)	Sample	Average age of sample	Risk variable	Age \times risk variable coefficient
Thaler and Rosen (1975)	Survey of Economic Opportunity 1967	41.8	Society of Actuaries 1967	Significant (5%), negative
Viscusi (1979)	Survey of Working Conditions, 1969–1970 (SWC)	39.7	BLS 1969, subjective risk of job (SWC)	Significant (1%), negative
Portney (1981)	Property values in Allegheny County, PA 1978	NA	Air pollution annual mortality rate data, EPA	VSL by age females (males): less than 45: \$1.5 (1.0) million; 45–64: \$0.3 (0.12) million; over 65: \$0.05 (0.05) million
Arnould and Nichols (1983)	U.S. Census 1970	NA	Society of Actuaries 1967	Significant (1%), negative
Moore and Viscusi (1988b)	QES 1977	38.1	Expected life years lost (=BLS fatality risk \times discounted remaining life)	Significant (1%), positive (implies risk premium increases with life expectancy, decreases with age, ceteris paribus)
Meng (1989)	National Survey of Class Structure and Labour Process 1981	39.9	Labour Canada and Quebec Occupational Health and Safety Board 1981	Significant (10%), negative
Meng and Smith (1990)	National Election Study 1984	NA	Labour Canada and Quebec Occupational Health and Safety Board 1981–83	Insignificant
Dillingham, Miller, and Levy (1996)	QES 1977	36.5	Constructed risk measure	Declining scale of WTP to avoid impaired workforce as function of age
Shannugam (1996/7)	Author's survey of blue collar manufacturing workers, Madras, India 1990	34.1	Administrative Report of Factories Act 1987–1990	Insignificant
Baranzini and Ferro Luzzi (2001)	Swiss Labour Force Survey, 1995, Swiss Wages Structure Survey, 1994	NA	Swiss National Accident Insurance Company, 1991–1995	Significant (1%), negative
Shannugam (2001)	Author's survey of blue collar manufacturing workers, Madras, India 1990	34.1	Administrative Report of Factories Act 1987–1990	Insignificant

Table 11. Summary of imputed discount rate studies, United States.

Year	Author (Year)	Type of study	Sample	Implicit discount rate (%)
1988	Moore and Viscusi (1988b)	Labor hedonic with reduced form discounting model	QES 1977	9.6–12.2
1989	Viscusi and Moore (1989)	Labor hedonic with structural Markov model	PSID 1982	10.7
1990	Moore and Viscusi (1990b)	Labor hedonic with structural life cycle model	PSID 1982	2.0
1990	Moore and Viscusi (1990c)	Labor hedonic with structural integrated life cycle model	PSID 1982	1.0–14.2
1995	Dreyfus and Viscusi (1995)	Automobile hedonic	1988 Residential Transportation Energy Consumption Survey	11–17

the Dreyfus and Viscusi's automobile hedonic study. Rational individuals can implicitly discount their health capital at a different rate than what they face in markets (e.g., real interest rate for a home mortgage) since health status is a non-traded commodity (one cannot "save" good health at age 25 for consumption at age 75). Despite this possibility, these models estimate discount rates that are broadly consistent with the real rates of interest typical workers and consumers face (see Table 11).

9. The application of the value of a statistical life to public policy decisions

At least in the countries with a high level of development, governments recommend or require economic analyses of proposed regulations and public policies.³⁶ Regulatory agencies in the United States, the United Kingdom, and Canada, have been most prominent in their use of VSL estimates to value the benefits of proposed environmental, health, and safety rules. In some cases, regulatory agencies have modified the VSL to account for distinctive characteristics of the risk and the affected population. In the United States, some environmental laws preclude the promulgation of regulations based on benefit-cost analysis. In these cases, analysts have turned to risk-risk analysis—based in part on an application of the value of a statistical life—to provide some guidance about whether a proposed policy is in fact risk reducing.

9.1. The use of VSLs in government decision-making around the world

9.1.1. United States. Over the past twenty years in the United States, executive orders by Presidents Carter, Reagan, and Clinton have mandated economic impact analyses of all significant Federal regulations (E.O. 12044, E.O. 12291 and E.O. 12866). Beginning with the Reagan Administration, these executive orders vested with the Office of Management and

Budget (OMB) the responsibility for overseeing and coordinating the review of regulatory impact analyses. OMB has published guidelines for all Federal agencies, such as its report with respect to the use of “best practices” in these analyses (U.S. OMB, 1996). The guidance recommends the use of a value of a statistical life to monetize the benefits associated with rules that change the population’s mortality risk. While OMB does not recommend a specific VSL or set of VSLs, it does provide a discussion of the issues agencies should consider when choosing a VSL based on the current state of knowledge.

Until the 1980s the dominant policy approach to valuing the benefits of reduced risks of death was based on various human capital measures, such as the present value of lost earnings and medical expenses. These values are lower than the VSL amounts. Typical of this approach was the 1982 analysis by OSHA of its proposed hazard communication regulation. OSHA valued lives saved based on the cost of death, which was the human capital value, because in its view life was too sacred to value. After OMB rejected the regulation, claiming that the costs exceeded the benefits, OSHA appealed the decision to then Vice-President Bush. W. Kip Viscusi was asked to settle the economic dispute between the two agencies. By valuing life properly using a VSL, the estimated benefits exceeded the costs. The regulation was approved the day after his analysis reached the Reagan White House.³⁷ Thus, the historical impetus for the adoption of the VSL methodology was that these values boosted assessed benefits by roughly an order of magnitude, improving the attractiveness of agencies’ regulatory efforts.

The flexibility provided to U.S. agencies in choosing a VSL appropriate to the population affected by their specific rules has resulted in significant variations in the selected VSL both across agencies and through time (see Table 12 and Adler and Posner, 2000). In addition, some regulatory impact analyses have included a range of benefits reflecting different assumptions about the VSL, often reflecting the age profile of the affected population by using a VSL adjusted by the number of life-years saved (e.g., the FDA rule restricting tobacco sales to children, 61 FR 44396, and the EPA rule regulating the sulfur content of gasoline, 65 FR 6698). The U.S. Environmental Protection Agency (EPA), responsible for more costly Federal rule-makings than any other U.S. agency, has developed economic guidelines for its regulatory impact analyses (U.S. EPA 2000a). The EPA guidelines recommend a VSL of \$6.2 million (2000 US\$), reflecting the arithmetic mean of 26 studies reviewed in Viscusi (1992a).

In contrast, the U.S. Federal Aviation Administration (1998) recommends a value of a statistical life of \$3 million in its 2002 economic analyses of regulations.³⁸ This comparatively low value of life may reflect in part an anchoring effect. The U.S. Department of Transportation was a leader in valuing mortality risk reductions, but began doing so in an era in which the present value of lost earnings was the dominant approach. The agency has slowly increased the value attached to reduced risks of death, but it has continued to lag behind the estimates in the literature.³⁹

9.1.2. United Kingdom. In the United Kingdom, the Cabinet Office has likewise provided guidance for economic analyses for the government’s regulatory and policy-making agencies (U.K. Cabinet Office, 2000; H.M. Treasury, 1997). While the guidance does not specify the value of a statistical life to be used by agencies, it does recommend careful

THE VALUE OF A STATISTICAL LIFE

55

Table 12. Values of a statistical life used by U.S. Regulatory Agencies, 1985–2000*.

Year	Agency	Regulation	Value of a statistical life (millions, 2000 \$)
1985	Federal Aviation Administration	Protective Breathing Equipment (50 Federal Register 41452)	\$1.0**
1985	Environmental Protection Agency	Regulation of Fuels and Fuel Additives; Gasoline Lead Content (50 FR 9400)	\$1.7
1988	Federal Aviation Administration	Improved Survival Equipment for Inadvertent Water Landings (53 FR 24890)	\$1.5**
1988	Environmental Protection Agency	Protection of Stratospheric Ozone (53 FR 30566)	\$4.8
1990	Federal Aviation Administration	Proposed Establishment of the Harlingen Airport Radar Service Area, TX (55 FR 32064)	\$2.0**
1994	Food and Nutrition Service (USDA)	National School Lunch Program and School Breakfast Program (59 FR 30218)	\$1.7, \$3.5**
1995	Consumer Product Safety Commission	Multiple Tube Mine and Shell Fireworks Devices (60 FR 34922)	\$5.6**
1996	Food Safety Inspection Service (USDA)	Pathogen Reduction; Hazard Analysis and Critical Control Point Systems (61 FR 38806)	\$1.9
1996	Food and Drug Administration	Regulations Restricting the Sale and Distribution of Cigarettes and Smokeless Tobacco to Protect Children and Adolescents (61 FR 44396)	\$2.7**
1996	Federal Aviation Administration	Aircraft Flight Simulator Use in Pilot Training, Testing, and Checking and at Training Centers (61 FR 34508)	\$3.0**
1996	Environmental Protection Agency	Requirements for Lead-Based Paint Activities in Target Housing and Child-Occupied Facilities (61 FR 45778)	\$6.3
1996	Food and Drug Administration	Medical Devices; Current Good Manufacturing Practice Final Rule; Quality System Regulation (61 FR 52602)	\$5.5**
1997	Environmental Protection Agency	National Ambient Air Quality Standards for Ozone (62 FR 38856)	\$6.3
1999	Environmental Protection Agency	Radon in Drinking Water Health Risk Reduction and Cost Analysis (64 FR 9560)	\$6.3
1999	Environmental Protection Agency	Control of Air Pollution from New Motor Vehicles: Tier 2 Motor Vehicle Emissions Standards and Gasoline Sulfur Control Requirements (65 FR 6698)	\$3.9, \$6.3
2000	Consumer Product Safety Commission	Portable Bed Rails; Advance Notice of Proposed Rulemaking (65 FR 58968)	\$5.0**

*This table augments a similar presentation of values of a statistical life used in U.S. regulatory analyses in Adler and Posner (2000) by including more regulations and presenting VSLs in constant year dollars.

**The published summaries of the regulatory impact analyses for these rules do not specify the year in which the reported dollars are denominated. We have assumed that the dollar year corresponds to the date of rule publication for purposes of converting all values into 2000 dollars. Note that the CPSC reported a VSL of \$5 million in both its 1995 and 2000 regulations; the difference in values reflects our deflating to 2000 dollars.

consideration of the challenges in applying values estimated in the economic literature to potentially different risk and population contexts of the policy or regulation.

The U.K. Department of the Environment, Transport, and Regions (DETR; formerly Department of Transport) has employed a willingness-to-pay based value of preventing a fatality since 1988 in its regulatory and policy analyses (Chilton et al., 1999). The value of preventing a fatality selected in 1988, \$1.2 million (£500,000 in 1987 prices), is still used by the Department. This value reflects contingent valuation-based estimates of individuals' willingness-to-pay for risk reduction. The U.K. Health and Safety Executive uses the DETR value of preventing a fatality as a starting point for its regulatory impact analyses. The HSE has employed a value of preventing a fatality double the DETR value for cancer-related fatalities, concluding that individuals' dread of the disease significantly outweighs the affects of latency on willingness-to-pay (Andrews and McCrea, 1999).⁴⁰

Whereas U.S. agencies rely on market-based VSL estimates, in the U.K. the emphasis is on contingent valuation estimates. This difference in approach no doubt stems in part from the different character of the empirical evidence in the two countries. There have been dozens of studies of U.S. wage-risk tradeoffs, most of which have been in a reasonable range. There have been far fewer such analyses for the U.K., and the resulting empirical estimates have been much more unstable.

9.1.3. Canada. In Canada, the Privy Council Office published guidelines for benefit-cost analysis in 1995. While these guidelines do not specify one or a set of values of a statistical life, they do note the need for serious consideration of the value of life, determinants of the appropriate VSL, and possible approaches to presenting useful information for policymakers and the public. The value of a statistical life is left to the discretion of agencies promulgating regulations, again much like the U.S. and U.K. approaches.

Transport Canada reviewed the economic analyses for 145 transportation-related projects over 1982–1993 (Blanchard, 1996). The VSL used in these analyses ranged from \$400,000 to \$3.2 million. A recent analysis of a Canadian proposed rule on tobacco products information used a range of the value of a statistical life of \$1.7–\$5.7 million,⁴¹ with higher values for individuals under age 65 (Hara Associates, 2000). A comparable range and age-based VSL differential was employed in an evaluation of a Canadian proposal for cleaner fuels in vehicles as well (Lang et al., 1995).

9.1.4. Multinational organizations. The value of a statistical life has also received attention in multinational contexts. The Intergovernmental Panel on Climate Change (IPCC), established by the United Nations Environment Programme and the World Health Organization in 1988 to provide technical support to participants in global climate change negotiations, discussed issues regarding the value of a statistical life in its 1995 and 2001 assessments of the economic and social dimensions of climate change (IPCC, 1996, 2001). Moreover, the European Commission (EC) began in 2000 a process to prepare guidance for benefits analysis to improve benefit-cost analysis procedures within the EC. The EC effort has focused a substantial amount of time and resources on the value of a statistical life question (EC, 2000).

9.2. *Issues pertaining to benefits transfers*

The vast majority of the studies reviewed in this paper cover prime-aged workers who have chosen to bear the risk of accidental, immediate death. Many of the studies based their quantitative analyses on samples from the 1970s and 1980s. With the exception of occupational safety policies, most government regulations affect mortality risks with different qualitative characteristics or affect populations with characteristics that differ from those of the samples in these studies. The demographic characteristics of specific groups and the population at large likely differ today (and will differ in the future) from what they were 20 to 30 years ago. The risk-money tradeoffs of those affected by government policy may differ from those values estimated in hedonic market studies.

For example, many environmental regulations address carcinogen exposure. Reduced cancer-related mortality presents several issues that merit consideration when employing a VSL. First, individuals may be willing to pay more to avoid dying of cancer than to avoid an instantaneous accidental death. Revesz (1999) hypothesizes that this “dread” effect of cancer mortality should result in an upward revision to the VSL. This reasoning apparently underlies the higher VSL used by the UK Health and Safety Executive for cancer-related fatalities. The EPA’s Science Advisory Board (2000) recommended against any “dread”-related modification to the value of a statistical life on the grounds that the current literature did not support any such change.⁴² In particular, contingent valuation estimates of cancer mortality risks have produced values similar to those observed for accidental deaths.⁴³ The market-based evidence for cancer risks discussed above is similar to the results for accident risks.

Cancer-related mortality also differs significantly from occupational mortality in terms of the timing of the death. The long latency period for cancer (and other chronic health conditions affected by government regulations) should be discounted in the benefits analysis (Revesz, 1999; Science Advisory Board, 2000). Given the rough similarity of the implicit rates of discount discussed in Section 8 to current market interest rates, a benefit-cost analysis could employ one common discount rate for all categories of benefits and costs.

Several researchers have questioned the discounting of benefits of reducing future risks to life when evaluating public policies. Heinzerling (1998, 1999, 2000) has criticized the discounting of statistical lives on moral grounds. She claims that a statistical life cannot be discerned from an actual life, which society would not attempt to price. This concern pertains to both current and future risk reductions and is not a discounting argument per se. While Heinzerling expresses significant concerns with the concept of statistical lives and in their discounting, individuals make private risk-income, risk-time, and risk-risk tradeoffs every day, as evidenced by the literature surveyed in this paper, as well as by simple casual observation.⁴⁴ Further, as the studies presented in Table 11 illustrate, individuals value risks in the future less than they value commensurate risks they face today. Both Revesz and Heinzerling raise concerns about discounting statistical lives in future generations (also see Arrow et al., 1996 for a survey of intergenerational discounting).

Failure to discount creates potentially fundamental paradoxes (see Keeler and Cretin, 1983). Suppose that the cost structure for reducing risks to life is unchanged over time. Then it is always desirable to defer any life saving policy and invest the money that would have been spent on risk reduction. Indeed, continual postponement of a life saving effort

is always desirable if future benefits are never discounted, but the money spent on these policies continues to grow at the rate of interest.

Similarly, suppose that future life saving benefits are not discounted. If, however, one converts the cost allocations to a terminal value rather than discounting the benefits back to a present value, the effect will be identical in terms of whether the policy passes a benefit-cost test. What the discounting critics generally fail to grasp is that what is being discounted are not lives but rather society's willingness to pay for these future risks to life.

The differences in the age of the population in labor market studies and of the population affected by a regulation should also affect the value of a statistical life. While fewer studies have focused on the effects of age on the return to risk, those that have tend to find that the value of a statistical life declines with age, consistent with the theoretical work. Since these labor hedonic studies include samples where age usually ranges no higher than about 60 years, it may be difficult to extrapolate these results for older populations. This is a significant issue in benefits transfer, since many environment and public health policies (as opposed to worker safety programs) deliver benefits to the elderly. For example, recent air quality regulations promulgated by the U.S. Environmental Protection Agency disproportionately benefit older individuals as illustrated by the average increase in life expectancy of less than 15 years (U.S. EPA, 1999; Science Advisory Board, 1999a). In response to this, the EPA's Science Advisory Board (SAB) has questioned the appropriateness of EPA's choice of a VSL for this population. The SAB notes that it "question[s] the application of a WTP estimate for prime-aged individuals to a population of older individuals and people who are in poor health" (p. 6). The SAB (1999b) has recommended that the EPA revise its VSL in light of this concern.

Several agencies already employ age-adjusted VSLs. As noted above, the economic analysis of a Canadian tobacco regulation employed a smaller VSL for individuals older than 65. The U.S. Food and Drug Administration regularly employs the value of statistical life-years, instead of VSLs, as a way to monetize the health benefits of their proposed rules. The U.S. Environmental Protection Agency has reluctantly conducted benefit-cost analyses with the value of statistical life-years approach. The clear findings in the theory and existing empirical evidence support such age adjustments. Future empirical research should further refine age-specific estimates of the value of a statistical life for use in regulatory analyses.

9.3. *The role of risk-risk analysis*

While the value of a statistical life can be used to monetize the benefits for risk policy evaluation, most laws do not require that agencies undertake such balancing and some laws in the United States actually preclude the consideration of benefit-cost analysis in setting standards. For example, the courts have interpreted the Clean Air Act such that the U.S. Environmental Protection Agency cannot base ambient air quality standards on benefit-cost analysis or an assessment of the costs.⁴⁵ Even if a benefit-cost test cannot be applied, policies that on balance harm individual health presumably should not be adopted. Several forms of risk-risk analysis can account for these various risk effects of policies in an effort to ascertain whether risk regulations on balance are risk reducing. While risk-risk analysis

cannot determine if a policy improves societal welfare, it can identify the policies that clearly do not improve societal welfare because they result in a net increase in mortality risk.

Four types of risk-risk tradeoffs could influence the net effect of a policy or regulation on a population's risk exposure. First, a policy may reduce risks of one type while increasing risks of another type. For example, the U.S. Food and Drug Administration considered banning saccharin, the artificial sweetener, in response to an animal study finding that it may be a potential human carcinogen. However, banning saccharin would likely increase the risks associated with obesity. In this case, the U.S. Congress allowed the use of saccharin in foods subject to a warning label on products containing the sweetener (Viscusi, 1994b).

Second, policies to reduce risks may create incentives for individuals to undertake less individual effort to reduce their exposure to risks (moral hazard). These behavioral responses will offset some of the risk reduction of the policy, and could potentially increase net risks. For example, Peltzman (1975) described how drivers responded to mandated safety devices in automobiles by changing their driving behavior. Drivers in "safer cars" drove more recklessly than before. The empirical evidence showed that while the safety measures reduced fatalities among automobile occupants, these gains have been offset at least in part by increases in pedestrian deaths and nonfatal accidents.

Third, risk-reduction policies may result in regulatory expenditures that directly increase fatalities. For example, policies to remove asbestos from buildings may increase asbestos exposure by workers and use of excavation equipment at Superfund hazardous waste sites may result in construction-related injuries and fatalities (Graham and Wiener, 1995). Viscusi and Zeckhauser (1994) illustrate through an input-output analysis the total direct and indirect injury and fatality risks associated with expenditures by industry. Regulations that require a reallocation of resources to industries with higher risks, for example towards construction to build new wastewater treatment facilities or to install pollution control technologies, would result in an offsetting increase in mortality risk.

Fourth, the costs of risk-reduction policies decrease income available to finance other health and safety expenditures. Wildavsky (1980, 1988) noted that the costs of risk-reduction policies reduce national income, some of which would otherwise be used to promote health and safety. This argument focuses on the correlation between income and health, evident in both international cross-sectional data and U.S. time-series data (Viscusi, 1983, 1994b; Graham, Chang, and Evans, 1992; Lutter and Morrall, 1994; see Smith, Epp, and Schwabe, 1994 for a critique of the international evidence).⁴⁶ These analyses illustrate that wealthier countries have lower mortality rates associated with greater health and safety investments. Graham, Chang, and Evans (1992) extended the previous analyses on the mortality-income relationship by focusing on the effect of permanent income. They conclude that: "If government regulation reduces the level (or the rate of growth) of permanent income, it is likely to cause smaller health investments and an eventual decline in health status compared to what would have occurred without the economic burdens of regulation" (p. 336).⁴⁷

Keeney (1990, 1994, 1997) formalized Wildavsky's proposition and found that some expensive regulations aimed at reducing mortality risks actually increase mortality risks by reducing national income. Keeney's model yields various estimates for the induced-expenditure associated with an additional fatality that depend on the distribution of the burden of the policy costs. Based on the mortality-income relationships estimated by Kitawaga

and Hauser (1973) and Frerichs et al. (1984), Keeney estimates that between \$13.6 million and \$15.2 million of expenditures would induce a fatality, assuming costs are borne proportional to income.^{48,49} This research inspired a legal opinion of an OSHA regulation in the early 1990s.⁵⁰ U.S. Federal Appeals Court Judge Steven F. Williams wrote that regulations that do not pass a risk-risk analysis would be counterproductive. The U.S. Office of Management and Budget then suggested to OSHA that it consider risk-risk analysis in conducting its regulatory impact analyses.

While the research on the income-mortality relationship influenced several policy discussions in the early 1990s in the United States, the results from these studies point towards a peculiar inconsistency. For the studies with expenditure-induced fatalities on the order of \$5 million per fatality, the expenditure associated with a loss of one life is on par or perhaps below what individuals are willing to pay to reduce the risk of one fatality in the population based on the labor market hedonic studies (Viscusi, 1994b). Moreover, the mortality-income studies also suffer several other potential problems. Some of these do not appropriately account for the simultaneity in the data—higher incomes allow individuals to invest more in health, but poor health often draws down an individual's income (Chapman and Hariharan, 1994).⁵¹ Some of these studies also may suffer from omitted variable bias resulting in misidentifying the relationship between income and health.

As an alternative to deriving the income-mortality relationship from aggregate data, Viscusi (1994a) illustrates how to generate an estimate for the expenditure-induced fatality rate based on the value of a statistical life and the marginal propensity to spend on health. Viscusi shows that

$$\text{marginal expenditure per statistical life lost} = \frac{\text{value of a statistical life}}{\text{marginal propensity to spend on health}}.$$

This approach requires an estimate of the value of a statistical life and an estimate of the marginal propensity to spend on health. The literature surveyed in previous sections provides estimates for the numerator. For the marginal propensity to spend on health, Viscusi estimated this based on an analysis of 24 OECD countries over the 1960–1989 period and a time-series analysis for the United States over the same period (Viscusi, 1992b, 1994a, 1994b). Over an array of specifications for both data sets, the marginal propensity to spend on health ranged from 0.08 to 0.12. This implies that for every dollar increase in national income, an additional 8 to 12 cents are spent on health care. Assuming a marginal propensity to spend on health of 0.1 and a VSL of about \$6 million, the marginal expenditure per statistical life lost would be about \$60 million.⁵²

Lutter, Morrall, and Viscusi (1999) extended Viscusi's (1994a) model to account for the effect of income to influence risky behaviors (such as smoking, drinking, and poor diet) as well as the consumption of health care. Their statistical analyses illustrate that higher incomes promote better health habits, including reduced excessive drinking and cigarette smoking and increased exercise. Including the effects of income on risky health behavior reduces the estimated marginal expenditure per statistical life lost from the Viscusi (1994a) by more than a factor of 3 to \$17 million. Lutter et al. note that policies that increase national income would reduce one fatality for every \$17 million increase. The authors also note that

since many regulations have costs per life saved of \$100 million or more, the expenditures may be wasteful and counterproductive.⁵³

If a regulation directly reduces mortality risk with regulatory-induced expenditures yielding a high cost per life saved ratio, then the indirect increase in mortality risk may exceed the direct decrease in risk resulting in an aggregate increase in societal mortality risk. The existing literature varies in terms of a preferred value for the amount of induced expenditures associated with an additional mortality. However, some regulations would clearly not pass a risk-risk analysis with any plausible value for an induced-expenditure mortality. For example, the 1986 OSHA regulation limiting asbestos occupational exposure cost about \$250 million per normalized life saved, and the 1987 OSHA regulation limiting formaldehyde occupational exposure cost about \$290 billion per normalized life saved (Viscusi, Hakes, and Carlin, 1997).

While the risk-risk literature has focused on mortality risks, many environment and safety regulations provide other kinds of benefits, such as reduced morbidity and injury as well as non-human health related effects such as improved visibility and ecosystem health (Lutter and Morrall, 1994; Portney and Stavins, 1994). A regulation that primarily delivers non-mortality benefits could fail a risk-risk analysis but still pass a benefit-cost analysis. One

Table 13. Evaluation of Risk-Risk Tradeoff for 24 U.S. Regulations, 1986–1998.

Regulation	Year	Agency	Discounted statistical lives saved	Fatalities induced by cost of regulations	Net lives saved by regulations
Toxicity characteristics to determine hazardous wastes	1990	EPA	0.048	–23	23
Underground storage tanks: technical requirements	1988	EPA	1.1	–22	24
Manufactured home construction and safety standards on wind standards	1994	HUD	1.5	–3.2	4.7
Process safety management of highly hazardous chemicals	1992	DOL	220	–42	260
Regulations restricting the sale and distribution of cigarettes and smokeless tobacco to protect children and adolescents	1996	HHS	4,700	–140	4,900
Medicare and Medicaid programs: hospital conditions of participation; identification of potential organ, tissue, and eye donors; and transplant hospitals' provision of transplant-related data	1998	HHS	710	9.2	700
Quality mammography standards	1997	HHS	75	1.4	74
Food labeling regulations	1993	HHS	520	10	510
Childproof lighters	1993	CPSC	95	2.9	92
Standard for occupational exposure to benzene	1987	DOL	4.4	1.8	2.6

(Continued on next page.)

Table 13. (Continued).

Regulation	Year	Agency	Discounted statistical lives saved	Fatalities induced by cost of regulations	Net lives saved by regulations
Occupational exposure to methylene chloride	1997	DOL	12	5.9	6.2
Occupational exposure to 4,4'- methylenedianiline	1992	DOL	0.7	0.71	-0.01
Asbestos: manufacture, importation, processing, and distribution in commerce—prohibitions (total)	1989	EPA	3.9	4.3	-0.41
National primary and secondary water regulations—phase II: maximum contaminant levels for 38 contaminants	1991	EPA	44	63	-19
Occupational exposure to asbestos	1994	DOL	13	20	-7.1
Hazardous waste management system—wood preservatives	1990	EPA	0.29	0.83	-0.55
Sewage sludge use and disposal regulations, 40 CFR pt. 503	1993	EPA	0.24	2.6	-2.3
Land disposal restrictions for “third third” scheduled wastes	1990	EPA	2.8	30	-27
Hazardous waste management system: final solvents and dioxins land disposal restrictions rule	1986	EPA	1	12	-11
Occupational exposure to formaldehyde	1987	DOL	0.21	4.8	-4.5
Prohibit the land disposal of the first third of scheduled wastes (“second sixth” proposal)	1988	EPA	2.9	66	-63
Land disposal restrictions—phase II: universal treatment standards and treatment standards for organic toxicity, characteristic wastes, and newly listed wastes	1994	EPA	0.16	8.3	-8.2
Drinking water regulations, synthetic organic chemicals—phase V	1992	EPA	0.0061	3.4	-3.4
Solid waste disposal facility criteria, 40 CFR pt. 257 and pt. 258	1991	EPA	0.0049	10	-10

Source: Hahn, Lutter, and Viscusi (2000).

approach could be to convert the morbidity effects into mortality risk equivalents. Alternatively one could focus on policies whose primary intent is to reduce mortality risks. Recognizing this criticism, Hahn, Lutter, and Viscusi (2000) conducted risk-risk analyses on a number of major environment, health, and safety regulations over the 1986–1998 period whose primary benefits were reduced mortality risk (see Table 13).⁵⁴ Their analysis focuses on 24 regulations promulgated by the U.S. Environmental Protection Agency (EPA), U.S. Department of Housing and Urban Development (HUD), U.S. Department of Labor (OSHA), and U.S. Consumer Products Safety Commission (CPSC). Thirteen of 24 regulations designed primarily to reduce mortality risks actually increased mortality risks

based on the Lutter et al. work finding that \$15 million of expenditures induces a fatality. Eight of these thirteen rules failing a risk-risk analysis had at least ten times more expenditure-induced fatalities than lives saved.⁵⁵

10. Conclusion

For nearly thirty years, economists have attempted to infer individuals’ preferences over mortality and morbidity risk and income in labor and product markets. The substantial literature that has developed over that time has confirmed Adam Smith’s intuition about compensating differentials for occupational hazards in a significant and growing number of countries. In addition to evaluating various international labor markets, the literature has expanded to address a variety of econometric issues, morbidity risk premiums, and factors influencing mortality risk premiums such as union affiliation and age.

While the tradeoff estimates may vary significantly across studies, the value of a statistical life for prime-aged workers has a median value of about \$7 million in the United States. Our meta-analysis characterizes some of the uncertainty in estimates of the value of a statistical life, and finds that the 95 percent confidence interval upper bounds can exceed the lower bounds by a factor of two or more. Other developed countries appear to have comparable VSLs, although some studies of the United Kingdom have found much larger risk premiums. Consistent with the fact that safety is a normal good, developing countries’ labor markets also have significant, but smaller, values of statistical life. Overall, our point estimates of the income elasticity of the value of a statistical life range from 0.5 to 0.6. Union members in U.S. labor markets appear to enjoy greater risk premiums than non-members, while the evidence in other developed countries is rather mixed. The theoretical and empirical literature indicates that the value of a statistical life decreases with age.

The estimates of the value of a statistical life can continue to serve as a critical input in benefit-cost analyses of proposed regulations and policies. Refining VSLs for the specific characteristics of the affected population at risk remains an important priority for the research community and the government agencies conducting these economic analyses. Improving the application of VSLs in this way can result in more informed government interventions to address market failures related to environmental, health, and safety mortality risks.

Appendix

Table A. Description of variables used in Viscusi-Aldy meta-analyses.

Variable	Description	Summary statistic, Viscusi-Aldy data
VSL	Value of a statistical life (millions, 2000 US\$)	\$6.7 (\$5.6)
Income	Annual labor income (2000 US\$)	\$26,006 (\$12,002)
Mean risk	Average mortality risk of sample	0.0002 (0.0003)
Hourly wage	Hourly wage or hourly equivalent of weekly income (2000 US\$)	\$13.00 (\$6.00)
Union VSL	VSL for union members only (dummy variable)	4/49

(Continued on next page.)

Table A. (Continued.)

Variable	Description	Summary statistic, Viscusi-Aldy data
Dillingham risk	VSL based on Dillingham (1985) constructed New York workers compensation-based fatality risk measure (d.v.)	1/49
Society of Actuaries risk	VSL based on Society of Actuaries 1967 mortality risk data (d.v.)	2/49
BLS risk	VSL based on BLS mortality risk measure (d.v.)	16/49
NIOSH risk	VSL based on NIOSH mortality risk measure (d.v.)	5/49
Subjective	VSL based on self-reported measure of mortality risk (d.v.)	1/49
Education level	Barro-Lee average educational attainment for population >25 by country (in years)	9.6 (2.0)
Unemployment rate	Annual unemployment rate by year of wage data	7.6 (4.6)
U.S. national data	VSL based on national U.S. worker sample (d.v.)	24/49
Non-U.S. study	VSL based on non-US wage-risk study (d.v.)	22/49
Male only sample	VSL based on male only sample (d.v.)	21/49
Blue collar sample	VSL based on blue collar only sample (d.v.)	15/49
Quadratic risk	VSL based on econometric specification quadratic in mortality risk (d.v.)	7/49
Morbidity variable included	VSL based on study that included an injury risk measure (d.v.)	25/49
log(Dependent variable)	VSL derived from specification with natural logarithm of dependent variable (d.v.)	44/49
Union D.V.	VSL based on specification that included dummy variable for union affiliation (d.v.)	32/49
Regional D.V.	VSL based on specification with regional dummy variables (d.v.)	24/49
Urban D.V.	VSL based on specification with urban/MSA dummy variable (d.v.)	13/49
Workers' compensation	VSL based on specification with workers' compensation variable (d.v.)	11/49
Wage in after tax terms	VSL based on specification with income expressed in after-tax terms (d.v.)	10/49
Industry D.V.	VSL based on specification with industry dummy variables (d.v.)	21/49
Occupation D.V.	VSL based on specification with occupational dummy variables (d.v.)	20/49
No occupation D.V.	Study does not include occupational dummy variables (dummy variable)	29/49
Job characteristics D.V.	VSL based on specification with variables describing job characteristics (d.v.)	10/49

Means (standard deviations) reported for continuous variables.

Share of studies in which variable equals 1 reported for dummy variables.

 $n = 49$.

Acknowledgments

Viscusi's research is supported by the Harvard Olin Center for Law, Business, and Economics, and the Environmental Protection Agency. Aldy's research is supported by the Environmental Protection Agency STAR Fellowship program. The authors thank James Hammitt, Randall Lutter, and Robert S. Smith for helpful comments on an earlier draft of this paper.

Notes

1. Past reviews of this literature include Smith (1979), Miller (1990), and Viscusi (1992, 1993, 2000). Several researchers have conducted meta-analyses of this literature, including Liu, Hammitt, and Liu (1997), Miller (2000), Bowland and Beghin (2001), and Mrozek and Taylor (2002). See Hammitt (2002) and Krupnick (2002) for commentaries on the Mrozek and Taylor paper.
2. For more extensive discussion of hedonic analysis, see Griliches (1971), Rosen (1974, 1986), Thaler and Rosen (1975), Smith (1979), and Viscusi (1979).
3. For a discussion of irrational behavior in the presence of mortality risk inconsistent with expected utility theory, refer to Viscusi (1998).
4. Individual risk neutrality or risk aversion, i.e., U'' , $V'' \leq 0$ is required to ensure a global maximum.
5. Gaba and Viscusi (1998) compared qualitative and quantitative subjective measures of on-the-job accident risk. They find that for a given level of quantitative risk, a college-educated individual is more likely to report that risk as "dangerous" than an individual with less than college education. For example, for those workers who report their quantitative risk as comparable to an annual injury risk of less than 1 in 20, half of the college-educated described their job risk as "dangerous" while only 19 percent of the less-than-college educated reported their job risk as such. This differences in the "danger" cutoff biases estimates of risk premiums in wages, and this bias has implications distinct from typical measurement error. Gaba and Viscusi find that subjective quantitative measures of risk yielded wage premiums more consistent with estimates based on objective risk measures (BLS). Analysis of the qualitative risk measure (a dichotomous 0-1 "is the job dangerous?" variable) produced a much larger risk premium.
6. Averaging over a period of 5 to 10 years would likely remove any potential distortions associated with catastrophic accidents in any particular year.
7. Viscusi (1979, 1980) includes the danger variable in some regressions, although his research focused on compensating differentials based on BLS measures of injury and fatality risk discussed below.
8. Leigh's (1991) analysis with risk data derived from workers' compensation records in 11 states appears to be the only U.S. study to aggregate such data from more than one state.
9. Averaging fatality risk data over several years can reduce the distortion of a catastrophic event in one year in one industry on the measure of an industry's risk.
10. Most hedonic wage-risk studies have not accounted for labor taxes in their construction of the wage variable or in their interpretation of the value of a statistical life. Exceptions include several papers that have focused on the effects of workers' compensation on the compensating differential for occupational risk (e.g., Moore and Viscusi, 1990a). This reflects the more common use of pre-tax wages in the broader labor market analysis literature.
11. In the product market context, Atkinson and Halvorsen (1990), Dreyfus and Viscusi (1995), and Gayer, Hamilton, and Viscusi (2000) employ Box-Cox transformations to evaluate their respective hedonic price models (the first two focused on automobile prices and the third on housing prices).
12. Viscusi (1978a) excluded the dummy variables out of concern of inducing multicollinearity between an industry-level risk measure and industry dummy variables. Refer to the discussion below on multicollinearity.
13. We focus our discussion here on their NIOSH data-based results for several reasons. First, we believe that the NIOSH data are superior to the 1980s BLS fatality risk data as discussed above. Second, the regression models based on non-NIOSH data in Dorman and Hagstrom have insignificant risk coefficients for all specifications—without industry dummy variables, with industry dummy variables, and with other industry characteristics.

While we are not certain why they did not find significant risk coefficients with the BLS risk data as previous researchers had, it seems moot to argue that a coefficient on a risk variable actually represents an industry effect if that coefficient is not significant.

14. We selected papers for inclusion in this literature review with a modest set of criteria. First, a study should be written in English. Second, a study should be published in either an academic journal or a book. Third, a study should provide enough information to calculate a value of a statistical life. In several cases, information provided in more recent papers (such as per capita incomes reported for some studies in Viscusi, 1993; Mrozek and Taylor, 2002) has been used with reported coefficient estimates to calculate the value of a statistical life for a study. Our aim is to characterize as best as possible the universe of wage-risk studies in the literature, so we have not attempted to purge this assessment of so-called "low quality" studies or to modify the value of a statistical life estimates from such studies. For some studies, we have presented a range of the value of a statistical life estimates and for others we have presented an illustrative point estimate. In the case of the latter, we have focused on the reported results for the whole sample (as opposed to union-only, blue-collar only, managerial-only, etc. samples) based on the econometric specification preferred by the studies' authors.
15. While these estimates have been adjusted to constant year dollars (2000 US\$), they have not been adjusted for differences in the samples' income levels. The per capita income data provided in Table 2 coupled with income elasticity estimates in Section 6 can be used to modify the values of a statistical life in Table 2 so that they reflect a common income level.
16. In this paper, we present all VSLs in terms of 2000 US\$. All domestic values are converted using the CPI-U deflator series (Council of Economic Advisers, 2002, Table B60). International conversions are made using purchasing power parity exchange rates from the Penn World Table 6.0 (see Summers and Heston, 1991; Aten et al., 2001, and Internet: <http://pwt.econ.upenn.edu>) and then converted to year 2000 dollars with the CPI-U deflator series.
17. Viscusi (1993) actually reports \$3–\$7 million in December 1990 US\$. This has served as a reference range in several subsequent value of a statistical life studies. Note that we have updated this range to 2000 US\$.
18. Also refer to Fishback and Kantor (1992) for a historical evaluation of compensating differentials for occupational risk in the late 19th century.
19. Smith (1983) also used the Hickey and Kearney carcinogen exposure index to complement his assessment of compensating differentials for injury risk in U.S. labor markets. He found that the index is significantly positively correlated with wages implying a risk premium for workers' operating in environments exposing them to more carcinogens. Further, Smith included a measure of total suspended particulates (TSP) based on the workers' locations and found a statistically significant and positive correlation between TSP and workers' wages. Since TSP has been linked with various respiratory diseases, this could illustrate another premium for workers' bearing long-term risks on the job.
20. The values we report reflect an assumed latency period of 10 years and a real discount rate of 3 percent. Note that the VSL estimates in parentheses in Table 2 represent the values reported by Lott and Manning. Employing a real discount rate of 7 percent, consistent with U.S. Office of Management and Budget (1992) guidance, over a 10-year period effectively reduces the VSL reported by Lott and Manning in half.
21. Meng (1991) attempted to account for occupational disease by including a variable that reflected the rate of heart attacks and industrial disease. However, very modest information about the basis for this variable is provided. It is difficult to discern whether the variable captures long-term work-related risks or simply a selection effect that contaminates the data like the Society of Actuaries data set.
22. The authors also report estimates using the less reliable pre-1992 BLS risk data.
23. Siebert and Wei (1998) found a concave wage-risk relationship with a risk and risk-squared specification for their analysis of the Hong Kong labor market. Meng and Smith (1990, 1999) found the same relationship in their assessments of the Canadian labor market. Baranzini and Ferro Luzzi (2001) likewise found the same relationship in their analysis of the Swiss labor market.
24. All these studies evaluate risk-income tradeoffs in the United States. In our survey of the literature, we found only one study focusing on behavior outside of the United States. Ghosh, Lees, and Seal (1975) study the tradeoff between highway speeds and mortality risk in the United Kingdom. They derive a value of a statistical life estimate of \$0.9 million.
25. We have discounted the reported VSLs assuming that homeowners perceive a 10-year latency period and use a 3 percent discount rate in making their housing decisions.

26. The difference between the mean subjective mortality risk and the objective mortality risk reported by the Taiwan Labor Insurance Agency is statistically significant at the 1 percent level.
27. Studies for which we do not have an income measure were omitted. We did not include the Baranzini and Ferro Luzzi paper on the Swiss labor market since we became aware of it in the spring of 2003, well after completing this analysis.
28. We also estimated a regression with the Mrozek and Taylor set of control variables, with an important exception of replacing the hourly earnings variable with the natural logarithm of annual income. With an OLS specification, we estimated an income elasticity of 0.76 with a 95 percent confidence interval of 0.20–1.32 ($n = 41$). In the robust regression with Huber weights specification, we estimated again a point estimate for the income elasticity of 0.76, but with a much tighter 95 percent confidence interval of 0.73–0.79 ($n = 38$). The income variable was statistically significant at the 5 percent level in the OLS regression and significant at the 1 percent level in the robust regression. The iterative weighting process in robust regression with this much larger set of control variables effectively eliminated several low-VSL studies relative to specification 6 in Table 8, which may have resulted in the larger elasticity.
29. The Science Advisory Board (2000) has supported EPA's adjustment of the VSL for income growth.
30. We also calculated the median predicted VSL values for the full and U.S. samples. For the full sample, the median predicted VSL never exceeded the mean predicted VSL in any of the six regression models by more than 14 percent, and the mean predicted VSL never exceeded the median predicted VSL by more than 15 percent. For the U.S. sample, the median predicted VSL exceeded the mean predicted VSL in all six regressions, but never by more than 7 percent.
31. For example, Dorsey (1983) estimated a statistically significant negative coefficient on the fatality risk variable and a statistically significant positive coefficient on the union \times risk interaction variable. This combination (with the union \times risk coefficient greater in magnitude than the fatality risk coefficient) results in a positive compensating differential for union workers and a negative differential for non-union workers.
32. Rosen's research yields results similar to the Jones-Lee (1976), Jones-Lee, Hammerton, and Phillips (1985) and Shepard and Zeckhauser (1982, 1984) finding that the value of a statistical life takes an inverted-U shape with respect to age. Also refer to Garber and Phelps (1997) for an assessment of quality-adjusted life-years (QALYs) in the cost-effectiveness literature. Jenkins, Owens, and Wiggins (2001) provide some evidence that the value of a statistical life is increasing over childhood through the pre-retirement years.
33. Modifying utility functions in this way would be analogous to constructing QALY measures, common to valuations based on health status in the health economics literature. The QALYs are usually based on stated preference methods (see Cutler and Richardson, 1997).
34. Based on Rosen's life cycle model, one would expect that the marginal value of another year is greater for an elderly person than for a middle-aged person but that the value of all future years declines with age for a given individual. Accounting for health status may counter the effect of increasing marginal values for a one-year life extension for an elderly person. If health status is decreasing in age, then it may be ambiguous whether the marginal value of another year increases with age.
35. Baranzini and Ferro Luzzi (2001) also conducted such an analysis of the Swiss labor market with the same method as used by Moore and Viscusi (1988b). Consistent with the results for the U.S. labor market, they found that the value of a statistical life is increasing in life expectancy. In Switzerland, they estimate that a 50-year old values his life less than one-half as much as a 35-year old.
36. For example, refer to the guidance to improve regulatory decision-making provided by the OECD (1995) to its member countries.
37. For a review of the substance of this analysis, see Viscusi (1992a).
38. Refer to Table E-1 at Internet: <http://www.api.faa.gov/economic/EXECSUMM.PDF> and <http://www.api.faa.gov/economic/742SECT2.PDF>.
39. The low VSL used by the agency also reflects a political dimension as well. In the early 1990s when Viscusi prepared the report that was subsequently published as Viscusi (1993) for the Federal Aviation Administration, that branch of the agency favored a higher value of life than was later mandated for use throughout the department.
40. Note that the Science Advisory Board to the U.S. Environmental Protection Agency considered the effects of latency and dread within the context of cancer-related mortality. The SAB (2000) concluded that the literature

does not currently support a modification of the value of a statistical life to reflect dread. In contrast, the SAB did recommend that economic analyses account for latency by discounting future mortality to the present time consistent with the approach to other categories of benefits and costs.

41. The conversion to U.S. dollars for the Hara Associates analysis was based on the annual market exchange rate reported by the Federal Reserve (refer to Internet: <http://www.federalreserve.gov/releases/g5a/current/>) because the Penn World Table does not provide conversions for the most recent years.
42. While Revesz suggests other adjustments to the value of a statistical life based on the qualitative characteristics of the risk, such as involuntariness of the risk, the Science Advisory Board (2000) noted that the existing literature does not justify adjustments for these effects.
43. See Magat, Viscusi, and Huber (1996).
44. This discussion implicitly acknowledges an important aspect of most occupational, safety, and environmental health risks: these risks are relatively small. In cases of certain, or near-certain death, the empirical economic evidence and this argument are not relevant (see our discussion in Section 1).
45. For example, the 1997 final rule for the national ambient air quality standard for ozone introduced the section on the regulatory impact analysis with the following: "As discussed in Unit IV of this preamble, the Clean Air Act and judicial decisions make clear that the economic and technological feasibility of attaining ambient standards are not to be considered in setting NAAQS, although such factors may be considered in the development of State plans to implement the standards. Accordingly, although, as described below, a Regulatory Impact Analysis (RIA) has been prepared, neither the RIA nor the associated contractor reports have been considered in issuing this final rule" (62 FR 38856).
46. This relationship is also revealed within a cross-section of the U.S. population. Viscusi (1978b) found that work-related risk exposure decreases with worker wealth.
47. Portney and Stavins (1994) question whether the income losses from regulations would reduce the population's health status. They claim that the nonlinear relationship between income and health and the modest impact of most regulations on the economy would not likely have a significant effect on health status. While individual regulations may involve small costs as a share of the economy, it is important to note that environmental regulations alone cost about 1–2 percent of U.S. economic output (U.S. OMB, 2001).
48. We have updated the reported values in Keeney (1990) to 2000 U.S. dollars using the CPI-U deflator.
49. The Keeney estimates are near the high end of 11 studies cited in Lutter and Morrall (1994) on the income gains necessary to avert one fatality. They are very similar to Lutter and Morrall's estimated range of \$11.4 million to \$15.2 million for the United States.
50. Refer to *UAW v. OSHA*, United States Court of Appeals for the District of Columbia Circuit, 89-1559.
51. A recent paper by Gerdtham and Johannesson (2002) attempts to address this problem by controlling for initial health status in regressions of mortality risk on income (with other relevant controls) for a study focusing on Sweden in the 1980s and 1990s. They find that an income loss ranging from \$7.5–\$10.8 million would induce an expected fatality in Sweden. The range reflects variation in the progressivity of the burden of the regulation.
52. Viscusi (1994a, 1994b) selected a VSL estimate of \$5 million (in 1992 US\$) because it represented the midpoint of the basic range for VSLs of \$3 million–\$7 million in Viscusi (1993). In 2000 US\$, the midpoint would be \$6.1 million.
53. Refer to Morrall (1986) and Tengs et al. (1995) for lists of regulations' cost-effectiveness for the United States. Tengs et al. found that for 124 environmental regulations (primarily toxin control), the median cost per life-year saved is \$3.3 million. About 15 percent of the environmental regulations exceeded \$100 million per life-year saved. Converting these life-year values to statistical life values would result in a significant number of regulations with incredibly exorbitant cost-effectiveness measures. Life-saving regulations in other sectors of the economy (e.g., health care, transportation) had much lower costs per life-year saved. Refer to Ramsberg and Sjoberg (1997) for an evaluation of the cost-effectiveness of lifesaving interventions in Sweden.
54. Hahn, Lutter, and Viscusi only considered regulations with reduced mortality risk benefits comprising at least 90 percent of total monetized benefits.
55. Note that the construction of discounted statistical lives saved reflects both an accounting for life-years saved and discounting for latency.

References

- Adler, M.D. and E.A. Posner. (2000). "Implementing Cost-Benefit Analysis When Preferences Are Distorted," *Journal of Legal Studies* 29, 1105–1148.
- Andrews, R.M. and P. McCrear. (1999). "UK Health and Safety Executive Approach to Exposure Limit Setting." In *Proceedings of the OECD Workshop on the Integration of Socio-Economic Analysis in Chemical Risk Management Decision Making*, London, January 7–9, 1998. Paris: Organization of Economic Cooperation and Development, pp. 193–202.
- Arabsheibani, G.R. and A. Marin. (2000). "Stability of Estimates of the Compensation for Danger," *Journal of Risk and Uncertainty* 20(3), 247–269.
- Arnould, R.J. and L.M. Nichols. (1983). "Wage-Risk Premiums and Workers' Compensation: A Refinement of Estimates of Compensating Wage Differential," *Journal of Political Economy* 91(2), 332–340.
- Arrow, K.J., W.R. Cline, K.-G. Maler, M. Munasinghe, J.E. Stiglitz, and R. Squitieri. (1996). "Intertemporal Equity and Discounting." In J.P. Bruce, H. Lee, and E. Haites (eds.), *Climate Change 1995: Economic and Social Dimensions*. Cambridge, England: Cambridge University Press, pp. 125–144.
- Aten, B., R. Summers, and A. Heston. (2001). *The Penn World Table Mark 6*. Philadelphia, PA: The Center for International Comparisons at the University of Pennsylvania. Internet: <http://pwt.econ.upenn.edu>.
- Atkinson, S.E. and R. Halvorsen. (1990). "The Valuation of Risks to Life: Evidence from the Market for Automobiles," *Review of Economics and Statistics* 72(1), 133–136.
- Baranzini, A. and G. Ferro Luzzi. (2001). "The Economic Value of Risks to Life: Evidence from the Swiss Labour Market," *Swiss Journal of Economics and Statistics* 137(2), 149–170.
- Barro, R.J. and J.W. Lee. (1996). "International Measures of Schooling Years and Schooling Quality," *American Economic Review* 86(2), 218–223.
- Berger, M.C. and P.E. Gabriel. (1991). "Risk Aversion and the Earnings of U.S. Immigrants and Natives," *Applied Economics* 23, 311–318.
- Biddle, J.E. and G.A. Zarkin. (1988). "Worker Preference and Market Compensation for Job Risk," *Review of Economics and Statistics* 70(4), 660–667.
- Blanchard, G. (1996). *Highway Benefit-Cost Analysis: A Review of Evidence*. Transport Canada, Economic Analysis, Special Infrastructure Project. Report no. TP12790E. Ottawa, Ontario.
- Blomquist, G. (1979). "Value of Life Saving: Implications of Consumption Activity," *Journal of Political Economy* 87(3), 540–558.
- Blomquist, G.C., T.R. Miller, and D.T. Levy. (1996). "Values of Risk Reduction Implied by Motorist Use of Protection Equipment," *Journal of Transport Economics and Policy* 30(1), 55–66.
- Bowland, B.J. and J.C. Beghin. (2001). "Robust Estimates of Value of a Statistical Life for Developing Economies," *Journal of Policy Modeling* 23, 385–396.
- Brown, C. (1980). "Equalizing Differences in the Labor Market," *Quarterly Journal of Economics* 94(1), 113–134.
- Bureau of Labor Statistics. (n.d.). *Census of Fatal Occupational Injuries*. Washington, DC: Department of Labor. Internet: <http://www.bls.gov/iif/oshcfoi1.htm>.
- Butler, R.J. (1983). "Wage and Injury Rate Responses to Shifting Levels of Workers' Compensation." In J.D. Worrall (ed.), *Safety and the Workforce: Incentives and Disincentives in Workers' Compensation*. Ithaca, NY: ILR Press, pp. 61–86.
- Carlin, P.S. and R. Sandy. (1991). "Estimating the Implicit Value of a Young Child's Life," *Southern Economic Journal* 58(1), 186–202.
- Chapman, K.S. and G. Hariharan. (1994). "Controlling for Causality in the Link from Income to Mortality," *Journal of Risk and Uncertainty* 8(1), 85–94.
- Chilton, S., J. Covey, L. Hopkins, M. Jones-Lee, G. Loomes, N. Pidgeon, and A. Spencer. (1999). "Annex: New Research Results on the Valuation of Preventing Fatal Road Accident Casualties." In *Health Costs Due to Road Traffic-Related Air Pollution: Economic Evaluation*, Prepared for the WHO Ministerial Conference on Environment and Health, London, June 1999. Bern, Switzerland: Federal Department of Environment, Transport, Energy and Communications, Bureau for Transport Statistics.
- Council of Economic Advisers. (2002). *Economic Report of the President*. Washington, DC: Government Printing Office.

- Cousineau, J.-M., R. Lacroix, and A.-M. Girard. (1992). "Occupational Hazard and Wage Compensating Differentials," *Review of Economics and Statistics* 74(1), 166-169.
- Cutler, D.M. and E. Richardson. (1997). "Measuring the Health of the U.S. Population," *Brookings Papers on Economic Activity, Microeconomics* 1997, 217-271.
- Dardis, R. (1980). "The Value of Life: New Evidence from the Marketplace," *American Economic Review* 70(5), 1077-1082.
- Desvousges, W.H., F.R. Johnson, H.S. Banzhof, R.R. Russell, E.E. Fries, K.J. Dietz, and S.C. Helms. (1995). *Assessing the Environmental Externality Costs for Electricity Generation*. Research Triangle Park, NC: Triangle Economic Research.
- Dickens, W.T. (1984). "Differences Between Risk Premiums in Union and Nonunion Wages and the Case for Occupational Safety Regulation," *American Economic Review* 74(2), 320-323.
- Dillingham, A.E. (1985). "The Influence of Risk Variable Definition on Value-of-Life Estimates," *Economic Inquiry* 23(2), 277-294.
- Dillingham, A.E., T. Miller, and D.T. Levy. (1996). "A More General and Unified Measure for Valuing Labour Market Risk," *Applied Economics* 28, 537-542.
- Dillingham, A.E. and R.S. Smith. (1984). "Union Effects on the Valuation of Fatal Risk." In Dennis, B.O. (ed.), *Proceedings of the Industrial Relations Research Association 36th Annual Meeting*. San Francisco, CA, December 28-30, 1983. Madison, WI: Industrial Relations Research Association, pp. 270-277.
- Dorman, P. and P. Hagstrom. (1998). "Wage Compensation for Dangerous Work Revisited," *Industrial and Labor Relations Review* 52(1), 116-135.
- Dorsey, S. (1983). "Employment Hazards and Fringe Benefits: Further Tests for Compensating Differentials." In J.D. Worrall (ed.), *Safety and the Workforce: Incentives and Disincentives in Workers' Compensation*. Ithaca, NY: ILR Press, pp. 87-102.
- Dorsey S. and N. Walzer. (1983). "Workers' Compensation, Job Hazards, and Wages," *Industrial and Labor Relations Review* 36(4), 642-654.
- Dreyfus, M.K. and W.K. Viscusi. (1995). "Rates of Time Preference and Consumer Valuations of Automobile Safety and Fuel Efficiency," *Journal of Law and Economics* 38(1), 79-105.
- Duncan, G.J. and B. Holmlund. (1983). "Was Adam Smith Right After All? Another Test of the Theory of Compensating Wage Differentials," *Journal of Labor Economics* 1(4), 366-379.
- European Commission. (2000). *Workshop on the Value of Reducing the Risk of Ill-Health or a Fatal Illness*. Proceedings, November 13, 2000, Brussels, Belgium. Internet: http://europa.eu.int/comm/environment/envec/others/proceedings_of_the_workshop.pdf.
- Fairris, D. (1989). "Compensating Wage Differentials in the Union and Nonunion Sectors," *Industrial Relations* 28(3), 356-372.
- Fairris, D. (1992). "Compensating Payments and Hazardous Work in Union and Nonunion Settings," *Journal of Labor Research* 13(2), 205-221.
- Fishback, P.V. and S.E. Kantor. (1992). "'Square Deal' or Raw Deal? Market Compensation for Workplace Disamenities, 1884-1903," *Journal of Economic History* 52(4), 826-848.
- Freeman, R.B. and J.L. Medoff. (1981). "The Impact of the Percentage Organized on Union and Nonunion Wages," *Review of Economics and Statistics* 63(4), 561-572.
- French, M.T. (1990). "Estimating the Full Cost of Workplace Injuries," *American Journal of Public Health* 80(9), 1118-1119.
- French, M.T. and D.L. Kendall. (1992). "The Value of Job Safety for Railroad Workers," *Journal of Risk and Uncertainty* 5(2), 175-185.
- Frerichs, R.R., J.M. Chapman, P. Nourjah, and E.F. Maes. (1984). *Cardiovascular Diseases in Los Angeles, 1979-1981*. Los Angeles: American Heart Association—Greater Los Angeles Affiliate, Inc.
- Gaba, A. and W.K. Viscusi. (1998). "Differences in Subjective Risk Thresholds: Worker Groups as an Example," *Management Science* 44(6), 801-811.
- Garbacz, C. (1989). "Smoke Detector Effectiveness and the Value of Saving a Life," *Economics Letters* 31, 281-286.
- Garber, A.M. and C.E. Phelps. (1997). "Economic Foundations of Cost-Effectiveness Analysis," *Journal of Health Economics* 16, 1-31.

- Garen, J. (1988). "Compensating Wage Differentials and the Endogeneity of Job Riskiness," *Review of Economics and Statistics* 70(1), 9–16.
- Gayer, T., J.T. Hamilton, and W.K. Viscusi. (2000). "Private Values of Risk Tradeoffs at Superfund Sites: Housing Market Evidence on Learning About Risk," *Review of Economics and Statistics* 82(3), 439–451.
- Gegax, D., S. Gerking, and W. Schulze. (1991). "Perceived Risk and the Marginal Value of Safety," *Review of Economics and Statistics* 73(4), 589–596.
- Gerdtham, U. and M. Johannesson. (2002). "Do Life-Saving Regulations Save Lives?" *Journal of Risk and Uncertainty* 24(3), 231–249.
- Gerking, S., M. de Haan, and W. Schulze. (1988). "The Marginal Value of Job Safety: A Contingent Valuation Study," *Journal of Risk and Uncertainty* 1(2), 185–199.
- Ghosh, D., D. Lees, and W. Seal. (1975). "Optimal Motorway Speed and Some Valuations of Time and Life," *Manchester School Economics and Social Studies* 43(2), 134–143.
- Graham, J.D., B.-H. Chang, and J.S. Evans. (1992). "Poorer is Riskier," *Risk Analysis* 12(3), 333–337.
- Graham, J.D. and J.B. Wiener. (1995). *Risks vs. Risks: Tradeoffs in Protecting Health and the Environment*. Cambridge, MA: Harvard University Press.
- Griliches, Z. (ed.). (1971). *Price Indexes and Quality Change*. Cambridge: Harvard University Press.
- Hahn, R.W., R.W. Lutter, and W.K. Viscusi. (2000). *Do Federal Regulations Reduce Mortality?* Washington, DC: AEI-Brookings Joint Center for Regulatory Studies.
- Hamermesh, D.S. (1978). "Economic Aspects of Job Satisfaction." In O. Ashenfelter and W. Oates (eds.), *Essays in Labor Market Analysis*. New York: John Wiley and Sons, pp. 53–72.
- Hamermesh, D.S. (1999). "Changing Inequality in Markets for Workplace Amenities," *Quarterly Journal of Economics* 114(4), 1085–1123.
- Hamermesh, D.S. and J.R. Wolfe. (1990). "Compensating Wage Differentials and the Duration of Wage Loss," *Journal of Labor Economics* 8(1), S175–S197.
- Hammitt, J.K. (2002). "Commentary on: What Determines the Value of Life? A Meta-Analysis," *Journal of Policy Analysis and Management* 21(2), 271–273.
- Hara Associates Inc. (2000). *Benefit/Cost Analysis of Proposed Tobacco Products Information Regulations*. Prepared for Health Canada and Consulting and Audit Canada. Ottawa, Ontario, June 5, 2000.
- Heinerling, L. (1998). "Regulatory Costs of Mythic Proportions," *Yale Law Journal* 107, 1981–2070.
- Heinerling, L. (1999). "Discounting Life," *Yale Law Journal* 108, 1911–1915.
- Heinerling, L. (2000). "The Rights of Statistical People," *Harvard Environmental Law Review* 24, 189–207.
- Hersch, J. (1998). "Compensating Differentials for Gender-Specific Job Injury Risks," *American Economic Review* 88(3), 598–627.
- Hersch, J. and T.S. Pickton. (1995). "Risk-Taking Activities and Heterogeneity of Job-Risk Tradeoffs," *Journal of Risk and Uncertainty* 11(3), 205–217.
- Hersch, J. and W.K. Viscusi. (1990). "Cigarette Smoking, Seatbelt Use, and Differences in Wage-Risk Tradeoffs," *Journal of Human Resources* 25(2), 202–227.
- Herzog, H.W. Jr. and A.M. Schlottmann. (1990). "Valuing Risk in the Workplace: Market Price, Willingness to Pay, and the Optimal Provision of Safety," *Review of Economics and Statistics* 72(3), 463–470.
- H.M. Treasury (1997). *"The Green Book": Appraisal and Evaluation in Central Government, Treasury Guidance*. London: Her Majesty's Stationary Office.
- Hwang, H.-S., W.R. Reed, and C. Hubbard. (1992). "Compensating Wage Differentials and Unobserved Productivity," *Journal of Political Economy* 100(4), 835–858.
- Intergovernmental Panel on Climate Change (IPCC). (1996). *Climate Change 1995: Economic and Social Dimensions of Climate Change*. Cambridge: Cambridge University Press.
- Intergovernmental Panel on Climate Change (IPCC). (2001). *Climate Change 2001: Mitigation*. Cambridge: Cambridge University Press.
- Ippolito, P.M. and R.A. Ippolito. (1984). "Measuring the Value of Life Saving from Consumer Reactions to New Information," *Journal of Public Economics* 25, 53–81.
- Jenkins, R.R., N. Owens, and L.B. Wiggins. (2001). "Valuing Reduced Risks to Children: The Case of Bicycle Safety Helmets," *Contemporary Economic Policy* 19(4), 397–408.
- Jones-Lee, M.W. (1976). *The Value of Life: An Economic Analysis*. Chicago: University of Chicago Press.

- Jones-Lee, M.W., M. Hammerton, and P.R. Phillips. (1985). "The Value of Safety: Results of a National Sample Survey," *Economic Journal* 95, 49–72.
- Keeler, E.B. and S. Cretin. (1983). "Discounting of Life-Saving and Other Nonmonetary Effects," *Management Science* 29(3), 300–306.
- Keeney, R.L. (1990). "Mortality Risks Induced by Economic Expenditures," *Risk Analysis* 10(1), 147–159.
- Keeney, R.L. (1994). "Mortality Risks Induced by the Costs of Regulation," *Journal of Risk and Uncertainty* 8(1), 95–110.
- Keeney, R.L. (1997). "Estimating Fatalities Induced by the Economic Costs of Regulation," *Journal of Risk and Uncertainty* 14(1), 5–24.
- Kim, S.-W. and P.V. Fishback. (1993). "Institutional Change, Compensating Differentials, and Accident Risk in American Railroading, 1892–1945," *Journal of Economic History* 53(4), 796–823.
- Kim, S.-W. and P.V. Fishback. (1999). "The Impact of Institutional Change on Compensating Wage Differentials for Accident Risk: South Korea, 1984–1990," *Journal of Risk and Uncertainty* 18(3), 231–248.
- Kitawaga, E.M. and P.M. Hauser. (1973). *Differential Mortality in the United States of America: A Study in Socioeconomic Epidemiology*. Cambridge, MA: Harvard University Press.
- Kniesner, T.J. and J.D. Leeth. (1991). "Compensating Wage Differentials for Fatal Injury Risk in Australia, Japan, and the United States," *Journal of Risk and Uncertainty* 4(1), 75–90.
- Krupnick, A. (2002). "Commentary on: What Determines the Value of Life? A Meta-Analysis," *Journal of Policy Analysis and Management* 21(2), 275–282.
- Lang, C., G. Yarwood, F. Lalonde, and R. Bloxam. (1995). *Environmental and Health Benefits of Cleaner Vehicles and Fuels*. Prepared for Canadian Council of Ministers of the Environment, Task Force on Cleaner Vehicles and Fuels, October 5, 1995.
- Lanoie, P., C. Pedro, and R. Latour. (1995). "The Value of a Statistical Life: A Comparison of Two Approaches," *Journal of Risk and Uncertainty* 10, 235–257.
- Leigh, J.P. (1981). "Compensating Wages for Occupational Injuries and Diseases," *Social Science Quarterly* 62(4), 772–778.
- Leigh, J.P. (1987). "Gender, Firm Size, Industry, and Estimates of the Value of Life," *Journal of Health Economics* 1, 331–344.
- Leigh, J.P. (1991). "No Evidence of Compensating Wages for Occupational Fatalities," *Industrial Relations* 30(3), 382–395.
- Leigh, J.P. (1995). "Compensating Wages, Value of a Statistical Life, and Inter-Industry Differentials," *Journal of Environmental Economics and Management* 28(1), 83–97.
- Leigh, J.P. and R.N. Folsom. (1984). "Estimates of the Value of Accident Avoidance at the Job Depend on the Concavity of the Equalizing Differences Curve," *Quarterly Review of Economics and Business* 24(1), 56–66.
- Liu, J.-T., J. Hammitt, and J.-L. Liu. (1997). "Estimating Hedonic Wage Function and Value of Life in a Developing Country," *Economics Letters* 57, 353–358.
- Liu, J.-T. and J.K. Hammitt. (1999). "Perceived Risk and Value of Workplace Safety in a Developing Country," *Journal of Risk Research* 2(3), 263–275.
- Lott, J.R. and R.L. Manning. (2000). "Have Changing Liability Rules Compensated Workers Twice for Occupational Hazards? Earnings Premiums and Cancer Risks," *Journal of Legal Studies* 29, 99–130.
- Low, S.A. and L.R. McPheters. (1983). "Wage Differentials and the Risk of Death: An Empirical Analysis," *Economic Inquiry* 21, 271–280.
- Lutter, R. and J.F. Morrall. (1994). "Health-Health Analysis: A New Way to Evaluate Health and Safety Regulation," *Journal of Risk and Uncertainty* 8(1), 43–66.
- Lutter, R., J.F. Morrall, and W.K. Viscusi. (1999). "The Cost-Per-Life-Saved Cutoff for Safety-Enhancing Regulations," *Economic Inquiry* 37(4), 599–608.
- Magat, Wesley, W. Kip Viscusi, and Joel Huber. (1996). "A Reference Lottery Metric for Valuing Health," *Management Science* 42(8), 1118–1130.
- Marin, A. and H. Psacharopoulos. (1982). "The Reward for Risk in the Labor Market: Evidence from the United Kingdom and a Reconciliation with Other Studies," *Journal of Political Economy* 90(4), 827–853.
- Marsh, Suzanne M. and Larry A. Layne. (2001). *Fatal Injuries to Civilian Workers in the United States, 1980–1995*. DHHS/NIOSH pub. no. 2001-129s. July. Washington, DC: Department of Health and Human Services.

- Martinello, F. and R. Meng. (1992). "Workplace Risks and the Value of Hazard Avoidance," *Canadian Journal of Economics* 25(2), 333–345.
- McLean, R.A., W.R. Wendling, and P.R. Neergaard. (1978). "Compensating Wage Differentials for Hazardous Work: An Empirical Analysis," *Quarterly Review of Economics and Business* 18(3), 97–107.
- McNeill, W.H. (1976). *Plagues and Peoples*. Garden City, NY: Anchor Press.
- Mellow, W. and H. Sider. (1983). "Accuracy of Response in Labor Market Surveys: Evidence and Implications," *Journal of Labor Economics* 1(4), 331–344.
- Meng, R. (1989). "Compensating Differences in the Canadian Labour Market," *Canadian Journal of Economics* 22(2), 413–424.
- Meng, R. (1991). "Compensating Wages for Long-Term Job Hazards in Canadian Industry," *Economics Letters* 36(3), 331–336.
- Meng, R.A. and D.A. Smith. (1990). "The Valuation of Risk of Death in Public Sector Decision-Making," *Canadian Public Policy—Analyse de Politiques* 16(2), 137–144.
- Meng, R. and D.A. Smith. (1999). "The Impact of Workers' Compensation on Wage Premiums for Job Hazards," *Applied Economics* 31(9), 1101–1108.
- Miller, P., C. Mulvey, and K. Norris. (1997). "Compensating Differentials for Risk of Death in Australia," *Economic Record* 73(223), 363–372.
- Miller, T.R. (1990). "The Plausible Range for the Value of Life—Red Herrings Among the Mackerel," *Journal of Forensic Economics* 3(3), 17–39.
- Miller, T.R. (2000). "Variations Between Countries in Values of Statistical Life," *Journal of Transport Economics and Policy* 34(2), 169–188.
- Moore, M.J. and W.K. Viscusi. (1988a). "Doubling the Estimated Value of Life: Results Using New Occupational Fatality Data," *Journal of Policy Analysis and Management* 7(3), 476–490.
- Moore, M.J. and W.K. Viscusi. (1988b). "The Quantity-Adjusted Value of Life," *Economic Inquiry* 26, 369–388.
- Moore, M.J. and W.K. Viscusi. (1990a). *Compensation Mechanisms for Job Risks*. Princeton: Princeton University Press.
- Moore, M.J. and W.K. Viscusi. (1990b). "Discounting Environmental Health Risks: New Evidence and Policy Implications," *Journal of Environmental Economics and Management* 18, S51–S62.
- Moore, M.J. and W.K. Viscusi. (1990c). "Models for Estimating Discount Rates for Long-Term Health Risks Using Labor Market Data," *Journal of Risk and Uncertainty* 3, 381–401.
- Morrall, J. (1986). "A Review of the Record," *Regulation* (Nov/Dec), 25–34.
- Mrozek, J.R. and L.O. Taylor. (2002). "What Determines the Value of Life? A Meta-Analysis," *Journal of Policy Analysis and Management* 21(2), 253–270.
- National Institute for Occupational Safety and Health (NIOSH). (2000). *Worker Health Chartbook, 2000*. Report no. 2000-127. U.S. Department of Health and Human Services. Internet: <http://www.cdc.gov/niosh/pdfs/2000-127.pdf>.
- Organization for Economic Cooperation and Development (OECD). (1995). *Recommendation of the Council of the OECD on Improving the Quality of Government Regulation*. Report OCDE/GD(95)95. Paris: OECD.
- Organization for Economic Cooperation and Development (OECD). (2001). *OECD Environmental Outlook*. Paris: OECD.
- Olson, C.A. (1981). "An Analysis of Wage Differentials Received by Workers on Dangerous Jobs," *Journal of Human Resources* 16(2), 167–185.
- Peltzman, S. (1975). "The Effects of Automobile Regulation," *Journal of Political Economy* 83(4), 677–726.
- Privy Council Office, Canada. (1995). *Benefit/Cost Analysis Guide for Regulatory Programs*. Ottawa, Ontario. Internet: http://www.pco-bcp.gc.ca/raoics-srdc/ProcGuides/cbgcontents_e.htm.
- Portney, P.R. (1981). "Housing Prices, Health Effects, and Valuing Reductions in Risk of Death," *Journal of Environmental Economics and Management* 8, 72–78.
- Portney, P.R. and R.N. Stavins. (1994). "Regulatory Review of Environmental Policy: The Potential Role of Health-Health Analysis," *Journal of Risk and Uncertainty* 8(1), 111–122.
- Ramsberg, J.A.L. and L. Sjöberg. (1997). "The Cost-Effectiveness of Lifesaving Interventions in Sweden," *Risk Analysis* 17(4), 467–478.

- Revesz, Richard L. (1999). "Environmental Regulation, Cost-Benefit Analysis, and the Discounting of Human Lives," *Columbia Law Review* 99, 941–1017.
- Rosen, S. (1974). "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition," *Journal of Political Economy* 82, 34–55.
- Rosen, S. (1986). "The Theory of Equalizing Differences." In O. Ashenfelter and R. Layard (eds.), *Handbook of Labor Economics*. Amsterdam: North-Holland, pp. 641–692.
- Rosen, S. (1988). "The Value of Changes in Life Expectancy," *Journal of Risk and Uncertainty* 1, 285–304.
- Sandy, R. and R.F. Elliott. (1996). "Unions and Risk: Their Impact on the Level of Compensation for Fatal Risk," *Economica* 63(250), 291–309.
- Sandy, R., R.F. Elliott, W.S. Siebert, and X. Wei. (2001). "Measurement Error and the Effects of Unions on the Compensating Differentials for Fatal Workplace Risks," *Journal of Risk and Uncertainty* 23(1), 33–56.
- Schelling, T.C. (1968). "The Life You Save May Be Your Own." In S.B. Chase (ed.), *Problems in Public Expenditure and Analysis*. Washington, DC: Brookings Institution, pp. 127–162.
- Science Advisory Board. (1999a). *Advisory Letter to Administrator Browner Regarding the Clean Air Act Amendments Section 812 Prospective Study of Costs and Benefits*. October 29, 1999. Internet: <http://www.epa.gov/sab/coua0002.pdf>.
- Science Advisory Board. (1999b). *Final Advisory Letter to Administrator Browner Regarding the Clean Air Act Amendments Section 812 Prospective Study of Costs and Benefits*. November 19, 1999. Internet: <http://www.epa.gov/sab/coua0003.pdf>.
- Science Advisory Board. (2000). *SAB Report on EPA's White Paper "Valuing the Benefits of Fatal Cancer Risk Reduction"*. Transmitted to the EPA by letter to Administrator Browner. July 27, 2000. Internet: <http://www.epa.gov/sab/eeacf013.pdf>.
- Shanmugam, K.R. (1996/7). "The Value of Life: Estimates from Indian Labour Market," *Indian Economic Journal* 44(4), 105–114.
- Shanmugam, K.R. (1997). "Value of Life and Injury: Estimating Using Flexible Functional Form," *Indian Journal of Applied Economics* 6(3), 125–136.
- Shanmugam, K.R. (2000). "Valuations of Life and Injury Risks," *Environmental and Resource Economics* 16, 379–389.
- Shanmugam, K.R. (2001). "Self Selection Bias in the Estimates of Compensating Differentials for Job Risks in India," *Journal of Risk and Uncertainty* 22(3), 263–275.
- Shepard, D.S. and R.J. Zeckhauser. (1982). "Life-Cycle Consumption and Willingness-to-Pay for Increased Survival." In M.W. Jones-Lee (ed.), *The Value of Life and Safety*. Amsterdam: North Holland.
- Shepard, D.S. and R.J. Zeckhauser. (1984). "Survival Versus Consumption," *Management Science* 30(4), 423–439.
- Shogren, J.S. and T. Stamland. (2002). "Skill and the Value of Life," *Journal of Political Economy* 110(5), 1168–1173.
- Siebert, W.S. and X. Wei. (1994). "Compensating Wage Differentials for Workplace Accidents: Evidence for Union and Nonunion Workers in the UK," *Journal of Risk and Uncertainty* 9(1), 61–76.
- Siebert, W.S. and X. Wei. (1998). "Wage Compensation for Job Risks: The Case of Hong Kong," *Asian Economic Journal* 12(2), 171–181.
- Smith, A. (1776). *The Wealth of Nations*. Chicago: University of Chicago Press. 1976 edition.
- Smith, R.S. (1974). "The Feasibility of an 'Injury Tax' Approach to Occupational Safety," *Law and Contemporary Problems* 38(4), 730–744.
- Smith, R.S. (1976). *The Occupational Safety and Health Act: Its Goals and Its Achievements*. Washington, DC: American Enterprise Institute.
- Smith, R.S. (1979). "Compensating Wage Differentials and Public Policy: A Review," *Industrial and Labor Relations Review* 32(3), 339–352.
- Smith, V.K. (1983). "The Role of Site and Job Characteristics in Hedonic Wage Models," *Journal of Urban Economics* 13, 296–321.
- Smith, V.K., D.J. Epp, and K.A. Schwabe. (1994). "Cross-Country Analyses Don't Estimate Health-Health Responses," *Journal of Risk and Uncertainty* 8(1), 67–84.
- Smith, V.K. and C.C.S. Gilbert. (1984). "The Implicit Valuation of Risks to Life: A Comparative Analysis," *Economics Letters* 16, 393–399.

- Smith, V.K. and C.C.S. Gilbert. (1985). "The Valuation of Environmental Risks Using Hedonic Wage Models." In M. David and T. Smeeding (eds.), *Horizontal Equity, Uncertainty, and Economic Well-Being*. Chicago: University of Chicago Press, pp. 359–385.
- Summers, R. and A. Heston. (1991). "The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950–1988," *Quarterly Journal of Economics* 106, 327–368.
- Tengs, T.O., M.E. Adams, J.S. Pliskin, D.G. Safran, J.E. Siegel, M.C. Weinstein, and J.D. Graham. (1995). "Five-Hundred Life-Saving Interventions and Their Cost-Effectiveness," *Risk Analysis* 15(3), 369–390.
- Thaler, R. and S. Rosen. (1975). "The Value of Saving a Life: Evidence from the Labor Market." In N.E. Terleckyj (ed.), *Household Production and Consumption*. New York: Columbia University Press, pp. 265–300.
- U.K. Cabinet Office. (2000). *Good Policy Making: A Guide to Regulatory Impact Assessment*. London: Cabinet Office Regulatory Impact Unit. Internet: <http://www.cabinet-office.gov.uk/regulation/2000/riaguide/default.htm>.
- U.S. Environmental Protection Agency. (1999). *The Benefits and Costs of the Clean Air Act 1990 to 2010*. Report 410-R-99-001. Washington, DC: Office of Air and Radiation, USEPA. Internet: <http://www.epa.gov/oar/sect812/copy99.html>.
- U.S. Environmental Protection Agency. (2000a). *Guidelines for Preparing Economic Analyses*. Report 240-R-00-003. Washington, DC: Office of the Administrator, USEPA. Internet: <http://yosemite1.epa.gov/ee/epa/eed.nsf/pages/guidelines>.
- U.S. Environmental Protection Agency. (2000b). *Regulatory Impact Analysis: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements*. Report 420-R-00-026. Washington, DC: Office of Air and Radiation, USEPA.
- U.S. Federal Aviation Administration. (1998). *Economic Values for Evaluation of Federal Aviation Administration Investment and Regulatory Program*. Report no. FAA-APO-98-8. Washington, DC: Department of Transportation. June. Internet: <http://www.api.faa.gov/economic/TOC.PDF>.
- U.S. Office of Management and Budget. (1992). *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*. Circular A-94. Washington, DC: The White House. Internet: <http://www.whitehouse.gov/omb/circulars/a094/a094.pdf>.
- U.S. Office of Management and Budget. (1996). *Economic Analysis of Federal Regulations Under Executive Order 12866*. Washington, DC: The White House. Internet: <http://www.whitehouse.gov/omb/inforeg/riaguide.html>.
- U.S. Office of Management and Budget. (2001). *Making Sense of Regulation: 2001 Report to Congress on the Costs and Benefits of Regulations and Unfunded Mandates on State, Local, and Tribal Entities*. Washington, DC: The White House. Internet: <http://www.whitehouse.gov/omb/inforeg/costbenefitreport.pdf>.
- Viscusi, W.K. (1978a). "Labor Market Valuations of Life and Limb: Empirical Evidence and Policy Implications," *Public Policy* 26(3), 359–386.
- Viscusi, W.K. (1978b). "Wealth Effects and Earnings Premiums for Job Hazards," *Review of Economics and Statistics* 60(3), 408–416.
- Viscusi, W.K. (1979). *Employment Hazards: An Investigation of Market Performance*. Cambridge, MA: Harvard University Press.
- Viscusi, W.K. (1980). "Union, Labor Market Structure, and the Welfare Implications of the Quality of Work," *Journal of Labor Research* 1(1), 175–192.
- Viscusi, W.K. (1981). "Occupational Safety and Health Regulation: Its Impact and Policy Alternatives." In J.P. Creche (ed.), *Research in Public Policy Analysis and Management*. Greenwich, CT: JAI Press, vol. 2, pp. 281–299.
- Viscusi, W.K. (1983). *Risk by Choice: Regulating Health and Safety in the Workplace*. Cambridge, MA: Harvard University Press.
- Viscusi, W.K. (1992a). *Fatal Tradeoffs: Public and Private Responsibilities for Risk*. New York: Oxford University Press.
- Viscusi, W.K. (1992b). *Wealth, Health Investments, and the Value of Life*. Report prepared for the U.S. Office of Management and Budget, Washington, DC.
- Viscusi, W.K. (1993). "The Value of Risks to Life and Health," *Journal of Economic Literature* 31, 1912–1946.
- Viscusi, W.K. (1994a). "Mortality Effects of Regulatory Costs and Policy Evaluation Criteria," *RAND Journal of Economics* 25(1), 94–109.
- Viscusi, W.K. (1994b). "Risk-Risk Analysis," *Journal of Risk and Uncertainty* 8(1), 5–17.
- Viscusi, W.K. (1998). *Rational Risk Policy*. New York: Oxford University Press.

- Viscusi, W.K. (2000). "The Value of Life in Legal Contexts: Survey and Critique," *American Law and Economics Review* 2(1), 195–222.
- Viscusi, W.K. and W. Evans. (1990). "Utility Functions that are Dependent on One's Health Status: Estimates and Economic Implications," *American Economic Review* 80, 353–374.
- Viscusi, W.K., J.K. Hakes, and A. Carlin. (1997). "Measures of Mortality Risks," *Journal of Risk and Uncertainty* 14(3), 213–233.
- Viscusi, W.K. and J. Hersch. (2001). "Cigarette Smokers as Job Risk Takers," *Review of Economics and Statistics* 83(2), 269–280.
- Viscusi, W.K. and M.J. Moore. (1989). "Rates of Time Preference and Valuations of the Duration of Life," *Journal of Public Economics* 38, 297–317.
- Viscusi, W.K. and C.J. O'Connor. (1984). "Adaptive Responses to Chemical Labeling: Are Workers Bayesian Decision Makers?" *American Economic Review* 74(5), 942–956.
- Viscusi, W.K. and R.J. Zeckhauser. (1994). "The Fatality and Injury Costs of Expenditures," *Journal of Risk and Uncertainty* 8(1), 19–41.
- Weiss, P., G. Maier, and S. Gerking. (1986). "The Economic Evaluation of Job Safety: A Methodological Survey and Some Estimates for Austria," *Empirica* 13(1), 53–67.
- White, H. (1980). "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity," *Econometrica* 48(3), 817–830.
- Wildavsky, A. (1980). "Richer is Safer," *The Public Interest* 60, 23–39.
- Wildavsky, A. (1988). *Searching for Safety*. New Brunswick, NJ: Transaction Books.

[NOTE: The 3 digit page numbers refer to the pagination in the Legislative History of the Federal Mine Safety and Health Act of 1977 prepared for the Subcommittee on Labor of the Committee of Human Resources, United States Senate; the other page numbers are those of the Senate Report included in that document.]

589

95TH CONGRESS }	SENATE	Calendar No. 154
1st Session }		{ REPORT
		{ No. 95-181

=====

FEDERAL MINE SAFETY AND HEALTH ACT OF 1977

MAY 16, 1977.--Ordered to be printed

Mr. Williams, from the Committee on Human Resources, submitted
the following
REPORT
together with
MINORITY VIEWS

[To accompany S. 717]

The Committee on Human Resources, to which was referred the bill (S. 717) to promote safety and health in the mining industry to prevent recurring disasters in the mining industry, and for other purposes, having considered the same, reports favorably thereon with an amendment and recommends that the bill (as amended) do pass.

INTRODUCTION

The hazards involved with the mining of coal and other materials and the need to provide for the health and safety of the nation's miners have long been a matter of Federal law.

As early as 1865, a bill was introduced in the Congress to

AB73-BKG-26

create a Federal Mining Bureau. However, little was done until a series of serious mine disasters occurred after the turn of the century, causing public demand for Federal action to stop excessive loss of life. In July 1910, an act of Congress established a Bureau of Mines in the Department of the Interior which was charged with making:

Diligent investigation of the methods of mining especially related to the safety of miners and the appliances best adapted to prevent accidents, the possible improvement of

590

2

conditions under which mining operations are carried on, the treatment of ores and other mineral substances, the use of explosives, the prevention of accidents, and other inquiries and technological investigations pertinent to said industries.

This act recognized the need to attack the hazards in the mineral industries. However, it contained a specific denial of "any right or authority in connection with the inspection or supervision of mines * * *" on the part of any Bureau employee.

It became apparent that the lack of inspection was a great shortcoming of the act. Action to establish inspection authority started in the 76th Congress when S. 2420 was introduced on May 16, 1939. The bill passed the Senate in early 1940. The House Committee on Mines and Mining held hearings but failed to report the bill.

When the bill was reintroduced in 1941, speedy House approval and subsequent Senate passage produced Public Law 49, 77th Congress. The law became known as title I of the Federal Coal Mine Health and Safety Act. The House committee report to accompany this legislation described the existing situation:

Investigation reveals no common standard of safety among the States, no common regulations, and, in addition to this, a lack of uniform enforcement of such regulations, as are in effect. The jurisdiction of the Federal Bureau of Mines is severely limited, and in fact it lacks authority to enter the underground workings without specific permission from the owners, and once inside, upon invitation only, it has no authority to publicize its findings or recommendations or improve or correct conditions either directly or indirectly.

In order to supplement the work of the State agencies, H.R. 2082, the bill under consideration, extends and enlarges the authority of the Federal Bureau of Mines. It is not regulatory in any sense. It merely authorizes the Bureau, through its representatives, to make inspections of the underground workings and publicize its findings and recommendations. These inspections may be made annually or when necessary, and are to be made in conjunction with the local State agencies so that there is no usurpation of the State authority.

The Bureau was given the authority to make inspections, yet it was still severely handicapped in that there was no provision for establishing safety standards for coal mines or for achieving compliance with the standards or recommendations of the Secretary. Steps have been taken since then to alleviate this handicap and to create laws which would provide needed protections to the miners of our Nation.

When the Federal Government operated a substantial portion of the Nation's coal mines during 1946 and 1947, an agreement was reached between the Secretary of the Interior and the Mine Workers' president, embodying a Federal Mine Safety Code. However, except for the brief period of time during which the mines were operated by the Government, the Mine Safety Code served only as a guideline to Federal inspectors and compliance by operators was purely voluntary.

Public Law 328, 80th Congress requested that coal operators and state mining agencies report the extent of compliance with the Bureau

591

3

of Mine recommendations. Seventeen coal mining states cooperated fully with the request, while 2 others cooperated partially and seven failed to cooperate in any extent. As a result of this cooperation it was learned that there was 33 percent compliance with the Bureau's recommendation while the act was in effect. Because this was primarily an information gathering piece of legislation, it lapsed after one year.

In 1951, 119 miners were killed in an explosion in West Frankfort, Ill. The deaths of these miners led to new legislation which was enacted in 1952 as Public Law 552, 82nd Congress.

In signing this bill into law on July 16, 1952, President Harry Truman commented that the law was "a significant step in the direction of preventing the appalling toll of death and injury to miners in underground mines."

Despite the major advances that had been made in the field of mine safety and health, major mine disasters continued to occur. A task force was established to investigate the mine safety situation and to make recommendations. A report was submitted in August, 1963. In 1966, Public Law 89-376 became law, partially fulfilling the task force recommendations. These amendments saw to it that coal mines employing 14 or fewer persons were included as title I mines. The Bureau was also given a new enforcement tool, a "reinspection closing order" enabling inspectors to prevent certain types of repeated violations by some operators.

The 1966 amendments only reached a small portion of the causes of fatalities and accidents occurring in mines. The larger number of such occurrences lay outside and beyond the reach of the Federal statute, and was left by Congress to be embraced by State laws and the Bureau of Mines Advisory Coal Mine Safety Code.

In enacting the Federal Metal and Non-Metallic Mine Safety Act of 1966 (Public Law 89-577) (herein, the Metal Act), the Congress was still paying specific heed to the hazardous nature of the mining industry.

The number and severity of the injuries experienced each year by persons employed in the extractive industries should be alarming to an America that prides itself on its * * * concern for the welfare of its citizens. (Sen. Report No. 1296, 89th Cong., 2d Session, Federal Metal and Non-Metallic Mine Safety Act, p. 5)

It was this condition which the Metal Act was designed to correct.

Similar concerns were the genesis for the Federal Coal Mine Health and Safety Act of 1969 (Public Law 91-153) (herein, the Coal Act).

The committee determined early in its consideration that the Nation can no longer accept the fatalistic attitude which permeates this industry that "coal mining is a hazardous occupation, and we cannot change this fact." Men's lives are at stake and those of their families who are dependent on them.

Despite the hazardous nature of this occupation,

the committee is convinced that these hazards can be substantially reduced or eliminated. Many are due to bad practices and a failure on the part of many, including the Federal Government,

592

4

to act vigorously years ago to change them.
(Senate Report No. 91-411, 91st Cong., 1st Session,
Federal Coal Mine Health and Safety Act of 1969, p. 13)

Yet, despite this considerable Congressional attention, our nation still experiences deaths and serious injuries in our mines at a rate which casts shame on an advanced, industrialized society. Every working day of the year, at least one miner is killed and sixty-six miners suffer disabling injuries in our nation's mines.

As disturbing is the frequency with which the nation is experiencing tragic mining disasters. Numerous disasters in both coal and non-coal segments of the industry underscore those areas of inadequacy of our current law and the fact that the enforcement and administration of our current mine health and safety programs has failed to produce the level of protection for our nation's miners which should be within the capacity of our current mine safety laws.

At the Sunshine Silver Mine in Idaho, in May, 1972, 91 miners died of carbon monoxide asphyxiation because they did not know how to use self-rescuers or because the failure of mine management to provide a secondary escape route trapped miners as much as a mile underground.

At Buffalo Creek, in February, 1972, 125 persons died when a dam burst sending a near tidal wave of murky water through the seventeen mile long valley, while the mining enforcement agency questioned its authority to regulate the coal mine impoundment dam in question.

At Blacksville, in July, 1972, nine miners at work behind a piece of equipment that caught fire were trapped and died in the mine because those at the scene of the fire had not been adequately trained in emergency procedures.

At Scotia, in March, 1976 twenty-three miners and three Federal inspectors died in two explosions of accumulated methane gas when the mine safety enforcement effort was unable to detect and address chronic conditions of inadequate ventilation in that mine.

Near Tower City, Pennsylvania, in February, 1977, nine miners died when water from an underground source inundated active workings, sending tons of water and debris coursing through the mine.

These tragic disasters and the hundreds of deaths and serious injuries which occur in our mine each year are testament to the inadequacies of our current mine safety and health laws and their past enforcement by the Department of the Interior. These recurrences signal a pressing need for legislative improvements in our mine safety and health programs.

It is unacceptable that years after enactment of these mine safety laws, miners can still go into the mines without even rudimentary training in safety. Mine operators still find it cheaper to pay minimal civil penalties than to make the capital investments necessary to adequately abate unsafe or unhealthy conditions, and there is still no means by which the government can bring habitual and chronic violators of the law into compliance.

The 1976 Scotia disasters occurred while the Committee was considering the inadequacies of the Metal and Coal Acts and the enforcement of those laws. The Scotia disasters demonstrated once again that until the Congress finally provides truly effective mine health and

593

5

safety laws and insists on responsive administration and enforcement of those laws, this problem will continue to occur.

BACKGROUND

Currently, the protection of safety and health of our nation's miners is provided by two separate statutes: the Metal Act and the Coal Act. The Coal Act is considerably more comprehensive in scope and reach than is the Metal Act. First, the Coal Act deals with matters of miners' health and safety, while the Metal Act deals primarily with miner safety. The Coal Act provides for civil penalties for violations of the Act's standards, while the Metal Act does not. The Coal Act provides for a considerably more complex and definitive set of standards with which an operator must comply, and all standards under the Coal Act are mandatory. Standards under the Metal Act are not generally as comprehensive and are often "advisory standards," failure to comply with which would not place the mine operator in violation

of the Act. Enforcement is considerably more thorough under the Coal Act than the Metal Act.

Enforcement of both laws is the responsibility of the United States Department of the Interior and is currently the function of the Mining Enforcement and Safety Administration (MESA) of the Department. MESA is under the administrative control of an Administrator, appointed by the President with the advice and consent of the Senate. While this responsibility was originally assigned to the Bureau of Mines, reaction to the Buffalo Creek, Sunshine and Blacksville disasters, and Congressional pressure to move mining safety and health enforcement responsibilities out of the Interior Department, led the Interior Department, in 1973, to establish MESA as an independent agency within the Department of the Interior. The Bureau of Mines still retains certain responsibilities for mine safety research under section 501 of the Coal Act and section 6(a) of the Metal Act; and a separate budget account number is maintained for this purpose.

The history of the Interior Department's enforcement of these laws, either by the Bureau of Mines or by MESA, demonstrated a basic conflict in the missions of the Department. In past years, the Department has pursued the goal of maximizing production in the extractive industries, which was not wholly compatible with the need to interrupt production which is the necessary adjunct of the enforcement scheme under the Metal and Coal Acts: even though, in the Committee's view, over the long-run, improved health and safety promotes greater productivity through reduction of "down-time" and improved employee morale. In addition, lowered workers' compensation premiums which should result from improved safety and health, can be expected to lower production costs. On the other hand, no conflict could exist if the responsibility for enforcing and administering the mine safety and health laws was assigned to the Department of Labor since that Department has as its sole duty the protection of workers and the insuring of safe and healthful working conditions.

Under the Coal Act, underground mines must be inspected no less frequently than four (4) times annually (Sec. 103(a)), and no advance warning of inspections is to be given. Unusually hazardous mines are to be inspected even more frequently, as often as once every

594

6

five (5) working days (Sec. 103(i)). Inspectors tour the mine and cite violations of the standards on a notice which indicates the standards violated and, the period of time within which the

operator must rectify (abate) the violations found. The inspector reinspects the mine after such time to insure that the violation has been abated. (Section 104). Where an inspector notes a condition or practice in a mine which could place miners in an imminent danger of death or harm before such condition or practice can be abated, the inspector is required to determine the areas of the mine affected by such condition or practice and order the miners in that area removed until the condition or practice is abated (Sec. 104(a)).

The inspectors notice is subsequently forwarded to the MESA Assessment Office where a proposed assessment of penalty for the violation is made. Assessments are based upon the criteria set forth in Section 109(a)(1) of the Act, to wit: the operator's history of previous violations, the appropriateness of the penalty to the size of the business, whether the operator was negligent, the effect of the penalty on the operator's ability to continue in business, the gravity of the violation, and the demonstrated good faith of the operator. Penalty assessments proposed are then communicated to the operator who may pay the penalty or attempt to negotiate a settlement with officials of the Assessment Office, or to litigate the proposed penalty before an Administrative Law Judge of the Office of Hearings and Appeals of the Department of the Interior. Review of the Administrative Law Judge's decision can be had by the Board of Mine Operations Appeals; and de novo review of the final agency action can be had in the United States District Court (Sec. 109(a)(4)).

Under the Metal Act, inspections of underground mines must be conducted no less frequently than once each year, with no minimum number of inspections of surface mines specified (Sec. 4). The Secretary may give advance warning of inspections. Inspectors tour the mine and note conditions which are violative of the standards promulgated under the Act. Where a condition is noted which could cause imminent danger to miners before that condition could be effectively abated, the inspector is authorized to issue a closure order which, as in the Coal Act, bars miners from working in the affected area until the condition is abated (Sec. 8(a)). Inspectors are also authorized to issue similar closure or withdrawal orders where the violation previously "noted" has not been abated within the time prescribed for such abatement (Sec. 8(b)). The Act does not authorize the assessment of civil penalties, and except for these possibilities of closure and withdrawal orders already noted, there is no penalty provision of the Act to induce operator compliance with the standards promulgated under the Act. The Metal Act provides that an operator may appeal the imposition of a closure or withdrawal order to the Secretary, and further provides an appeal from the Secretary's final order to the Federal Metal and Non-Metallic Mine Safety Board of Review established under Section 10 of the

Act. Perhaps indicative of the ineffectiveness of the Metal Act is the fact that by 1975 the Board had not received a single appeal from an adverse action of the Secretary, and the Board was disbanded by Act of Congress.

595

7

OVERSIGHT OF MINE HEALTH AND SAFETY ENFORCEMENT

Review of the ten years of enforcement of the Metal act, and six years of enforcement of the Coal Act, requires the Committee to report that fatalities and disabling injuries in our nation's mines are still unacceptably and unconscionably high. According to the 1974 Annual Report on Occupational Safety and Health, the incidence of work related injuries and illnesses for miners exceeded the "all-industry" rate by about 14 percent. (Report, at p. 50). Work related deaths showed, even more forcefully, the inadequacies of the current mine safety and health laws and their enforcement. According to the Report, "about one out of every 1500 mine workers and one out of every 2800 railroad workers was killed on the job or died from work related injuries or illnesses in 1973, compared with one out of every 4000 construction workers and only one out of every 12,400 for all workers covered by OSHA." (Annual Report for 1974 on Occupational Safety and Health, at p. 50.)

The following table of the rates of fatal and serious non-fatal occurrences in our nation's mines since these laws became effective evidence. The need for a legislative solution.

TABLE 1.--FATAL AND DISABLING INJURY RATES, EXCLUDING MILLING OPERATIONS

[Per million man-hours]

Year	Coal	Metal/ nonmetal	Mining industry total
1966:			
Fatal.....	1.01	0.47	0.69
Disability injury.....	44.04	25.11	32.77
1967:			
Fatal.....	.94	.46	.66
Disability injury.....	42.53	24.13	31.91

1968:			
Fatal.....	1.42	.51	.89
Disability injury.....	42.29	24.30	31.80
1969:			
Fatal.....	.88	.49	.65
Disability injury.....	42.95	23.60	31.66
1970:			
Fatal.....	1.05	.43	.70
Disability injury.....	45.60	26.43	34.85
1971:			
Fatal.....	.76	.42	.56
Disability injury.....	49.82	26.42	36.37
1972:			
Fatal.....	.62	.87	.74
Disability injury.....	49.65	25.45	37.84
1973:			
Fatal.....	.51	.53	.52
Disability injury.....	43.73	24.16	33.41
1974:			
Fatal.....	.48	.50	.49
Disability injury.....	31.12	25.84	28.43
1975:			
Fatal.....	.44	.35	.40
Disability injury.....	31.78	21.97	27.33
1976:			
Fatal.....	.40	.33	.36
Disability injury.....	39.31	19.12	30.51

596

8

The Committee's oversight has taken the form of hearings on Health and Safety in the Coal Mines (June 26, August 6, 7, 14, and 17, 1970), the Buffalo Creek Disaster (May 30-31, 1972). Oversight on the Implementation of the Federal Coal Mine Health and Safety Act (September 5, 1972), and the Scotia Mine Disaster (Joint Hearings with the Education and Labor Committee of the House) (May 7, and 13, June 16, 1976). The Committee also conducted investigations of the Blacksville, Sunshine, Buffalo Creek, and Scotia Disasters. In addition, at the Committee's request, the General Accounting Office has issued reports on the following subjects: B-170686 (May 13, 1971) Problems in Implementation of the Federal Coal Mine Health and Safety Act of 1969; B-170866 (July 5, 1973) Follow-up on Implementations of the Federal Coal Mine Health and Safety Act of 1969; B-170686 (Dec. 31, 1975) Improvements Still needed in Coal Mine Dust-Sampling Program and Penalty Assessments and Collections; National Bureau

of Standards Report, An Evaluation of the Accuracy of the Coal Mine Dust Sampling Program Administered by the Department of the Interior; B-166582 (February 12, 1976) Analysis of Closure Orders issued under the Federal Metal and Non-metallic Mine Safety Act of 1966.

As a result of this oversight experience the Committee must draw a number of conclusions about the current mine safety laws and the enforcement and administration of those laws:

First, the Metal Act does not provide effective protection for miners from health and safety hazards and enforcement sanctions under that Act are insufficient to encourage compliance by operators.

Second, enforcement of safety and health laws should be the responsibility of agencies which are generally responsible for the needs of workers.

Third, both the Coal and the Metal Acts do not provide means to react quickly enough to newly manifested health hazards.

Fourth, the procedures by which safety and health standards are made under both the Metal and the Coal Act are much too slow and cumbersome for standards promulgated under those Acts to keep pace with developments in a dynamic and expanding industry.

Fifth, the assessment and collective civil penalties under the Coal Act have resulted in penalties which are much too low, and paid much too long after the underlying violation to effectively induce meaningful operator compliance.

Sixth, enforcement sanctions under the current laws are insufficient to deal with chronic violators.

The Committee believes that there is great need to encourage young people to go into the occupation of mining as the need of our nation for the minerals and energy sources extracted from the earth continues to increase. It is the Committee's feeling that the duty of the Congress, if it is to encourage such employment, is to make that employment as safe as possible. The experience of the past ten years clearly indicates that not all that can be done has been done to promote health and safety in our nation's mines.

The Committee's oversight of the enforcement and administration of the mine safety laws has demonstrated that the Department of the Interior has been seriously deficient in past years in its enforcement

597

9

and administrative responsibilities under these statutes. S. 717 is designed and drafted to correct these deficiencies and make the enforcement of the mine safety laws more responsible to the demonstrated needs of our nation's miners and the mining industry.

The Administration concurs in these findings and supports the transfer of the mine safety and health program to the Labor Department. Secretary of Interior Cecil D. Andrus testified before the Labor Subcommittee, and said that "the numbers of fatalities and serious injuries * * * are still unacceptably high * * * and the increase in MESA issued violation notices indicates there is still insufficient incentive for operators to correct and prevent health and safety violations before the inspector arrives at the mines." "[A]ll too often the operator finds it cheaper to pay the penalties than to strive for a violation-free mine."

The Committee strongly believes that industry-wide compliance with strong health and safety standards must be a basic ground rule for increased production.

The Secretary of the Interior, stated that the improvements which this bill makes in current laws "are absolutely necessary" and "must not be compromised." Among these are:

- one statute for both coal and metal/nonmetal mines, affording equal protection for all miners and a common regulatory program for all operators.

- a statutory general duty for operators to provide workplaces free from hazards likely to cause death or harm;

- mandatory time schedules for standards development to expedite the rulemaking process;

- increased emphasis on development of health standards;

- strengthened enforcement mechanisms;

- mandatory training standards; and finally

- proved procedures for assessment and collection of civil penalties.

The Secretary urged enactment of the bill at the "earliest possible moment".

CHRONOLOGY OF THE BILL

S. 2117, and S. 1302, similar measures were introduced in the 93rd and 94th Congresses, respectively. No action was taken on

S. 2117 in the 93rd Congress. S. 1302 was favorably reported by the then Committee on Labor and Public Welfare, but there was insufficient time for the Senate to consider the measure prior to adjournment sine die in October of 1976.

S. 717, the Federal Mine Safety and Health Amendments Act of 1977 was introduced by Chairman Harrison A. Williams, Jr., with twenty-five co-sponsors on February 11 (legislative day, February 1,) 1977, and was referred to the Committee on Human Resources.

The Subcommittee on Labor held hearings on the bill on March 30 and 31, and April 1, 1977. The Subcommittee heard testimony from witnesses representing the Federal Government, unions which represent miners, the mining industry and the general public. Government witnesses included: Secretary of the Interior, Cecil D. Andrus; Acting Assistant Secretary of the Interior (Energy and

598

10

Minerals), William D. Bettenberg; Administrator, Mining Enforcement and Safety Administration, Robert E. Barrett; Assistant Secretary of Labor (Policy, Evaluation and Research), Arnold H. Packer; Solicitor of Labor, Carin Ann Claus; and Deputy Solicitor of Labor, Robert B. Lagather.

Witnesses from the United Mine Workers, United Steelworkers of America, the Oil, Chemical and Atomic Workers, and the Cement, Lime and Gypsum workers testified on behalf of unions who represent miners.

Industry witnesses included officers of National Coal Association, American Mining Congress, Gypsum Association, Association of Bituminous Contractors, National Crushed Stone Association and Trona Mining Companies.

The public's interest was represented by witnesses from the Center for Law and Social Policy. Additional statements for the Record were received from the National Limestone Institute and National Sand and Gravel Association.

The Subcommittee on Labor unanimously reported S. 717 to the Committee on Human Resources on Wednesday, April 20, 1977, and the Committee on Human Resources considered the measure in Executive Session on Tuesday, May 3, 1977, and ordered S. 717 favorably reported to the Senate with amendments.

Amendments adopted in Full Committee

In Executive Session, the Committee on Human Resources agreed to a series of amendments without objection. They are as follows:

Section 102(a) of Section 201 is amended to require the Secretary to the extent practicable, to promulgate separate safety and health standards applicable to mine construction work which is done on the surface.

Section 102(a)(3) of Section 201 is amended to permit the Secretary of Labor to subpoena testimony and the production of evidence in connection with the hearings held as a part of the standard making process.

Section 102(a)(3) of Section 201 is amended by deleting references to standard making hearings as "informal".

Section 104(f)(1) of Section 201 is amended to require the Secretary to inspect mines upon written, specific complaints of miners or their representatives that hazardous conditions exist in those mines.

Section 116 of Section 201 is amended to require the Secretary to promulgate standards dealing with the safety and health training of mine construction workers.

Section 301 is amended to authorize the Director of the Office of Management and Budget, in consultation with the Secretaries of Labor and the Interior to make determinations necessary with respect to the transfer of enforcement and administrative responsibilities from the Interior to the Labor Department.

Section 303(a)(3) is amended to increase the appropriation authorization for mine safety and health research to \$60,000,000.

Section 303(d) is amended to increase the appropriation authorization for state grant programs to \$10,000,000, with the proviso that at least half the sums actually appropriated shall go to coal mining states.

599

11

A SUMMARY OF S. 717, THE FEDERAL MINE SAFETY AND HEALTH AMENDMENTS ACT OF 1977

Protection of the safety and health of miners is presently provided for under two statutes administered by the Department of the Interior: The Metal Act enacted in 1966 and applicable to

mines other than coal mines and the Coal Act. The occupational safety and health of practically all other nongovernmental workers is provided for under the Occupational Safety and Health Act of 1970 administered by the Department of Labor.

The basic approach taken by S. 717 is to combine protection of all miners under a single comprehensive law the Federal Mine Safety and Health Act of 1977 administered by the Department of Labor, which adopts the best features of each of the three current statutes dealing with worker health and safety. The Coal Act is amended to make it applicable to all mines and The Metal Act is repealed. All functions and responsibilities of the Secretary of the Interior in the area of mine safety and health (e.g. are transferred to the Secretary of Labor, to develop, promulgate, and enforce safety and health standards) except for the responsibility to administer the National Mine Health and Safety Academy and to conduct mine safety research which is retained by the Secretary of the Interior. The Mining En [sic] Department under a new Assistant Secretary to administer the new enforcement [sic] and Safety Administration is established within the Labor Act and an independent Mine Safety and Health Review Commission is established to review orders, citations and penalties.

The basic provisions of the bill, which would create the new Federal Mine Safety Act are as follows:

1. Mine safety and health standards.--All existing standards under the Coal Act and all mandatory standards under the Metal Act are retained under the bill. The Secretary can promulgate new standards, if needed, but new standards in areas covered by existing standards cannot reduce existing levels of protection. Advisory standards under the Metal Act are to be referred to an Advisory Committee to be empaneled within 60 days of enactment. The Committee is to review these standards and report to the Secretary those which warrant promulgation as new, mandatory standards. The Secretary shall order an abbreviated rule-making procedure, and after a period for public comment, promulgate such of these standards as he finds warranted as new mandatory standards. Operators are required, under a "Duties" provision, to provide a place of employment "free from hazards that are likely to cause death or harm." Separate standards are to prevail for the coal and non-coal segments of the industry, generally.

The Secretary of Labor, with the aid of advisory committees if he so requests, may issue a proposed rule modifying or revoking existing standards or proposing new ones. Whether based on an Advisory Committee's recommendations or not, the Secretary starts the rule or standard making procedure by publishing a proposed rule or standard in the Federal Register for public and industry

comment. A hearing, if requested, is to be had, and after full opportunity for public input, the Secretary may publish the standard. Standards dealing with toxic substances are to be based on the best available

600

12

evidence, are to be stated to the extent practical, in terms of objective criteria and are to be established to most adequately assure that miners shall suffer no material impairment if exposed to the standard level throughout their working life.

Special procedures are provided for:

Emergency Temporary Standard--when miners are exposed to grave danger due to toxic substances or other hazards--with immediate commencement of rule-making proceedings for permanent standards after Federal Register publication of the temporary standard.

Variances from the application of standards--where the variances would provide at least as safe and healthful conditions as compliance with the standard.

Persons adversely affected by a promulgated standard may challenge its validity in an appropriate United States court of appeals.

The bill requires at least four inspections each year for all underground mines in their entirety, and at least two inspections a year for all surface mines in their entirety, and at least one spot inspection every 5 working days for particularly hazardous mines.

The bill permits operators and miners or representatives to accompany inspectors, and permits miners to request inspections in writing if they suspect a hazardous situation exists, or to point out hazardous conditions to an inspector. The bill permits the Secretary to take appropriate action to protect persons and evidence in case of an accident in a mine.

After making an inspection of a mine, an inspector will issue a citation to the mine operator indicating any violations of the health or safety standards or the general duty clause. In addition to the violations, the citation specifies a time period within which the violation must be fully abated. Within a reasonable time after the citation, the Secretary must notify the operator of the proposed penalty. These procedures are patterned

on the current Coal Act.

The inspector may also issue a closure order (a sanction retained from the Coal Act) under certain prescribed circumstances, including the presence of an imminent danger or an operator's failure to fully abate a violation within the time specified in the citation, or the operator's unwarranted failure to comply with the Act's requirements or the existence of a violation of a significant and substantial nature after the operator has established a pattern of such violations in the mine. The closure order closes a mine or a portion of the mine affected by the particular condition or practice to all but essential personnel until such time as the conditions or practices resulting in its issuance have been abated.

Violators of the Act are also subject to a variety of civil and criminal penalties, derived primarily from the Coal Act. Maximum civil penalties range from \$250 assessable against miners who violate smoking-related standards to as much as \$10,000 for each violation of the Act by a mine operator and as much as \$1,000 per day for each day beyond the prescribed abatement period that a mine operator's violation remains unabated. Imposition of civil penalties for violations is mandatory, although the amount assessed is based upon the gravity of the violation, the operator's good faith, the history of violations at the mine and the size of the mine.

601

13

The bill also grants the U.S. district court power to formulate an appropriate remedy, including injunctive relief, to insure that miners are afforded the Act's protections where the Secretary can show, based on past violations or other facts, that there is a pattern of violations of the Act's requirements which constitute a continuing hazard to the health and safety of miners.

A five member Mine Safety and Health Review Commission is created as a separate entity. The Commission is empowered to act in panels of three members. The Commission serves as the ultimate administrative review body for disputed cases arising under the new mine safety act. An operator or affected party or employee representative may appeal to the Commission the issuance of a closure order or of any proposed penalty. Miners or their representative, or Operators may contest to the Commission a citation issued to an operator that fixes an abatement period they believe is unreasonable. In all such cases, the Commission is to afford an opportunity for a hearing. Administrative Law

Judges of the Commission shall hear matters before the Commission and issue decisions affirming, modifying or vacating the Secretary's order, proposed penalty or extending the abatement period set in the citation. A decision of an ALJ shall become the final order of the Commission within 40 days unless review is directed by the Commission. The Commission's review of a decision of the ALJ on appeal shall be discretionary. Two members of the Commission may authorize such review. The Commission may also review cases on its own initiative and remand cases to an ALJ for further proceedings where warranted.

Persons adversely affected by the Commission's final order may obtain a review of such order in any appropriate U.S. court of appeals. The Secretary may also obtain review or enforcement of any final order to the Commission in an appropriate U.S. court of appeals.

Any such review or enforcement proceeding in the court shall be based on the record developed before the Commission and other pleadings. No objection not argued before the Commission shall be heard by the Court (except in extraordinary circumstances) and findings of fact by the Commission shall be conclusive if based upon substantial evidence in the record as a whole.

The health research functions now performed by the Bureau of Mines with regard to mine safety and health will be transferred to the National Institute of Occupational Safety and Health (NIOSH), in the Department of HEW. Specifically, NIOSH is authorized to conduct research related to the development of mine health standards in the same way that it now performs that function under OSHA. Safety research and operation of the mine academy will continue to be conducted by the Secretary of the Interior in coordination with the Secretary of Labor.

THE PROVISIONS OF S. 717

The Committee believes that it is essential that there be a common regulatory program for all operators and equal protection under the law for all miners. Thus, a principal feature of the bill is the establishment of a single mine safety and health law applicable to the entire mining industry. The Committee also believes that the Coal Act should serve as the framework for this approach, but recognizes that a number of changes in the Act are essential for the establishment of such a strengthened mine safety and health program.

TITLE I

Title I of S. 717 contains amendments to the definitions in the Coal Act, which reflect both the broader jurisdiction of that Act, and makes refinements which nearly seven years of experience with the administration and enforcement of the Act have indicated are necessary.

Thus, for example, the definition of "mine" is clarified to include areas, both underground and on the surface, from which minerals are extracted (except minerals extracted in liquid form underground), and also, all private roads and areas appurtenant thereto. Also included in the definition of "mine" are lands, excavations, shafts, slopes, and other property, including impoundments, retention dams, and tailings ponds. These latter were not specifically enumerated in the definition of mine under the Coal Act. It has always been the Committee's express intention that these facilities be included in the definition of mine and subject to regulation under the Act, and the Committee here expressly enumerates these facilities within the definition of mine in order to clarify its intent. The collapse of an unstable dam at Buffalo Creek, West Virginia, in February of 1972 resulted in a large number of deaths, and untold hardship to down-stream residents, and the Committee is greatly concerned that at that time, the scope of the authority of the Bureau of Mines to regulate such structures under the Coal Act was questioned. Finally, the structures on the surface or underground, which are used or are to be used in or resulting from the preparation of the extracted minerals are included in the definition of "mine". The Committee notes that there may be a need to resolve jurisdictional conflicts, but it is the Committee's intention that what is considered to be a mine and to be regulated under this Act be given the broadest possibly interpretation, and it is the intent of this Committee that doubts be resolved in favor of inclusion of a facility within the coverage of the Act.

Similarly, the definition of mine "operator" is expanded to include "any independent contractor performing services of construction at such mine." It is the Committee's intent to thereby include individuals or firms who are engaged in construction at such mine, or who may be, under contract or otherwise, engaged in the extraction process for the benefit of the owner or lessee of the property and to make clear that the employees of such individuals or firms are miners within the definition of the Federal Mine Safety and Health Act of 1977. In enforcing this Act, the Secretary should be able to issue citations, notices, and orders, and the Commission should be able to assess civil penalties against such independent contractors as well as against the owner, operator, or lessee of the mine. The

Committee notes that this concept has been approved by the federal circuit court in Bituminous Coal Operators' Assn. v. Secretary of the Interior, 547 F2d 240 (C.A. 4, 1977).

TITLE II

Title II of S. 717 rewrites and substantially revises title I of the Coal Act. That title contains the principal administrative and enforcement sections of the Coal Act, and will contain the enforcement and administrative provisions of the new mine safety and health law. While title I of the Coal Act contains a comprehensive

603

15

administration and enforcement mechanism which has, in fact, served as the model for subsequent occupational health and safety legislation, including the Occupational Safety and Health Act and this Act, seven years of Committee oversight into the administration and enforcement of the Coal Act has demonstrated that there is a need for certain reforms to these procedures. Difficulties have developed in the administration and enforcement of the Coal Act which need to be corrected, so that miners can be afforded maximum protection.

While the noted deficiencies in the current law will be discussed more fully below, it is useful to summarize them in order to indicate why the Committee felt these changes were essential. Basically, they fall into two broad areas, standard making and penalty assessment and collection.

The standards are the key element in the statutory scheme to afford safe and healthful working conditions for our nation's miners. To do this, the mechanism by which standards are made and revised must be efficient. Standards must be generated on demonstrated needs of miners. This has not, in the past, been the case. Although the need for standards on impoundments and refuse piles was graphically illustrated by the Buffalo Creek tragedy in February, 1972, such standards were not proposed under the Coal Act until January 1974, and were not finally promulgated and effective until November 1975, forty-five months after the Buffalo Creek flood. Standards for lighting requirements for underground coal mines, which the 1969 Coal Act required the Secretary to propose within nine months of enactment, were not finally promulgated until October of 1976 and will not be finally effective until April of 1978. The nearly non-existent rate of promulgation of improved health standards under the Coal Act has been a great disappointment to the Committee, and demonstrates

that the procedure for promulgating health standards is of the basic flaws in the standard making mechanism of that Act.

The assessment and collection of civil penalties under the Coal Act has also been a great disappointment to the Committee. The Committee firmly believes that the civil penalty is one of the most effective mechanisms for insuring lasting and meaningful compliance with the law. Simple comparison of the improvements in the rates of fatal and serious non-fatal occurrences in both the coal industry, under the civil penalty systems, and the metal/non-metallic industry under a system of no civil penalties clearly indicates the effect, in terms of improved safety and health to miners, of the civil penalty system. (See table 1, supra.)

The civil penalty system under the Coal Act, has, since the effective date of that Act been fraught with difficulties which have hampered its effectiveness. The Secretary's initial penalty assessment procedures was initially determined to be improper by the court, and a new procedure was established. The new procedure resulted in low initial assessments. While low penalty assessments constitute one disturbing element of the current civil penalty system, the Committee is equally disturbed by the rather long period of time between citation of the initial violation and the final payment of the penalty associated with that violation. After the 1976 Scotia mine disaster, the Labor Subcommittee investigated the violation history of that mine and the

604

16

assessment and payment of civil penalties. Table 2 indicates that the period of time between citation of the violation and payment of penalties was too long to constitute an effective inducement to compliance.

TABLE 2.--SUMMARY SCHEDULE OF AVERAGE ASSESSMENT AND
COLLECTION TIMES FOR VIOLATIONS ON SCOTIA
MINE--1974 THROUGH THE FEB. 6,
ORDER OF ASSESSMENT

Category of violations	Average days from violation to	Average days from violation to	Minimum days from violation to	Maximum days from violation to
---------------------------	--	--	--	--

assessment collection assessment assessment

Ventilation violations, 30 CFR, pt. 75, subpart D.....	198	270	91	413
Fire protection violations, 30 CFR, pt. 75, subpart I.....	181	259	114	342
Combustible materials and rock dusting violations, 30 CFR, pt. 75, subpart E.....	203	272	98	345
Electrical equipment-- general, 30 CFR, pt. 75, subpart F.....	191	252	62	345
Roof support violations, 30 CFR, pt. 75, subpart C.....	194	259	124	317
Safely standard violation for surface work areas of underground coal mines, 30 CFR, pt. 77.....	272	343	115	353
Trailing cable and grounding cable violations, 30 CFR, pt. 75, subparts G and H.....	225	297	62	345
Maps, hoisting and mantrip violations, 30 CFR, pt. 75, subparts M and O.....	208	250	135	270
Dust standard violations, 30 CFR, pt. 70, subpart B.....	237	267	47	750
Miscellaneous violations, 30 CFR, pt. 75, subpart R.....	229	287	62	442

The Committee firmly believes that to effectively induce compliance, the penalty must be paid by the operator in reasonably close time proximity to the occurrence of the underlying violation. A number of problems with the current penalty assessment and collection system interfere with this. Final determinations of penalties are not self-enforcing, and operators have the right to seek judicial review of penalty

determinations, and may request a de novo trial on the issues in the U.S. District Courts. This encourages operators who are not predisposed to voluntarily pay assessed penalties to pursue cases through the elaborate administrative procedure and then to seek redress in the Courts. Since the District Courts are still reluctant to schedule trials on these cases, and the Department of Justice has been reluctant to pursue such cases in the courts, the matters generally languish at that stage, and the penalties go uncollected. In the seven years since the effective date of the Coal Act virtually no penalties have been collected as a result of court decisions.¹

¹ [Footnote] This Interior Solicitor has recently called this matter to the attention of the Attorney General.

U.S. DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SOLICITOR,
April 26, 1977.

Hon. GRIFFIN BELL,
Attorney [sic] General,
Washington, D.C.

DEAR MR. ATTORNEY GENERAL: As I am sure you are aware the Mining Enforcement and Safety Administration, a component of The Department of the Interior, is charged with enforcement of the Federal Coal Mine Health and Safety Act of 1969, 30 U.S.C. 1 801, et seq. The Act provides for the imposition of civil penalties for violation of health and safety standards. Court enforcement of civil penalties imposed

605

17

under the Act is accomplished through the appropriate United States Attorney under the supervision and guidelines established by the Assistant Attorney General for the Criminal Division.

It is our policy to have strong effective enforcement of the Coal Act particularly with regard to the imposition and collection of civil penalties and to this end we have, or are in the process of initiating many procedural and substantive changes to our existing methods of assessing and enforcing civil penalties. It has been brought to my attention that at present there are numerous civil penalty cases which have been referred to various United States Attorneys throughout the country that

must be characterized as "overdue" for action. I believe that these cases represent approximately five million dollars in penalties and that the primary backlogs are in three districts, i.e., the Western District of Virginia, the Eastern District of Kentucky and the Southern District of West Virginia.

It is our opinion that forceful action must be taken to aid these districts to move these cases forward to conclusion. As you can imagine the sheer volume of this backlog significantly hinders our ability to conduct a strong enforcement program. On behalf of Secretary Andrus, I would appreciate your personal attention in working towards a resolution of this problem. If we can be of any assistance in this regard, please let me know.

Sincerely,

Solicitor.

This lack of compulsion has encouraged the Department of the Interior to accept offers of compromise on assessed penalties, on the perhaps understandable rationalization that accepting such compromises would enable some penalties to be collected, and would shorten the time span between underlying violation and payment of the penalty. The result of such compromises, is that the initial assessments, already too low in the Committee's estimation, are often further reduced, and the amounts actually paid by operators for violations which are quite serious in many cases, are a mere slap on the wrist--too little to effectively induce meaningful compliance by operators with the safety and health requirements of the law.

The administrative and enforcement provisions of S. 717, then, to the extent that they augment the similar provisions of the Coal Act, do so within the concept of a comprehensive safety and health law applicable to the entire mining industry.

Operator's duty

Under this legislation, operators would have the duty to furnish miners places of employment which are free from recognized hazards that are causing or likely to cause death or harm to miners (Sec. 101 (a)). The purpose is to require the elimination of recognized hazards that are not specifically covered by a standard. A recognized hazard should be readily apparent to an operator, or a hazard which though not readily apparent, can be detected by commonly utilized tests in the industry or used by other organizations, governmental or non-governmental, recognized in the fields of industrial hygiene

or industrial safety.

606

18

While this duty places the primary responsibility for providing a safe and healthful working environment on the operator, who, of course, ultimately has the authority to operate the mine, the Committee recognizes that creation and maintenance of a safe and healthful working environment is not the task of the operator alone. If the purposes of this legislation are to be achieved, the effort must be a joint one, involving the miner and his representative as well as the operator. Accordingly, Subsection (b) of Section 101 establishes the miner's duty to comply with the Act and its requirements. It is the intention of the Committee that this duty will foster the necessary cooperation between miner and operators which the Committee believes must be encouraged if the nation's mines are to be made truly safe.

Thus, while miners are required to comply with standards insofar as they are applicable to their own actions and conduct, except with respect to the penalty for smoking in a mine, (Section 111(i)), neither the bill, nor current law contemplates that citations and penalties be issued against miners. Operators have the final responsibilities for affording safe and healthful workplaces for miners, and therefore, have the responsibility for developing and enforcing through appropriate disciplinary measures, effective safety programs that could prevent employees from engaging in unsafe and unhealthful activity.

Standard setting

S. 717 establishes procedures for the promulgation, modification or revocation of mandatory safety and health standards. By establishing a timetable which governs each step of the standards promulgation procedure, it seeks to eliminate delays in standards-setting.

Section 102(a)(1) provides that the standard promulgation procedure shall commence when the Secretary deems that there is a demonstrated need for such a standard as a result of information which he develops or which comes to him from other sources. While the section mentions some possible sources of such information, that list is not intended to be exclusive. It is the Committee's intent that the Secretary consider recommendations for standards which come from any source with pertinent information or knowledge of mine safety or health, industrial hygiene, or similar fields.

In initiating the standard promulgation procedure the Secretary may, in his discretion, make use of an advisory committee. If the Secretary desires to use an advisory committee, he is obligated by the statute to give the advisory committee no more than 180 days within which to make its recommendation (sec. 102(a)(1)), and he must publish his proposed rule in the Federal Register within 60 days of the advisory committee's recommendation or the reasons for his determination not to do so. Where recommendations, accompanied by appropriate criteria, are received from the National Institute for Occupational Safety and Health (NIOSH), the Secretary must within 60 days commence standards promulgation procedures. In such circumstances, he must, within the specified time period, either refer the matter to an advisory committee, publish a proposed standard, or publish the reasons for a determination not to issue a proposed standard.

The Committee wishes to emphasize that the use of advisory committees in the standard making process is discretionary. This discretion is given to the Secretary so that he has a clear mandate to utilize

607

19

an advisory committee if he so chooses, and not to indicate that the Committee expects the Secretary to use advisory committees in connection with any specific standard setting.

While S. 717 does not retain the present requirement in the Coal Act (Sec. 101(c)) for "pre-proposal consultation" with interested parties, the bill would not preclude the Secretary from engaging in such consultations, since the Secretary has the clear authority and responsibility to consult with interested parties in connection with standard making. Pre-proposal consultation often has been a useful tool for the Secretary, and the Committee concurs that such consultation does not require chartering of an advisory committee under the Federal Advisory Committee Act. Consultations may include persons of the various interests and viewpoints, be open to the public and whenever possible be announced in the Federal Register. Transcripts of such meetings are not required.

After publication of a proposal in the Federal Register, interested persons have a period of 30 days within which to file written comments. The Committee recognizes that in certain cases, as where a complex or highly technical proposal is published, or when a major revision of existing standards is undertaken, it may be desirable to extend the comment period. S.

717 provides that the Secretary may extend the comment period upon a finding of good cause published in the Federal Register.

If a hearing is requested, the Secretary must publish a notice of hearing within 60 days of the close of the comment period. Any hearing must commence within 60 days after publication of the notice of hearing.

In conducting such hearings, the Secretary is authorized to establish procedural rules which will enable him to fulfill his duty to develop a record necessary to fully explain the pertinent facts and issues in the most efficient and expeditious manner possible. It is essential that undue delay, or redundancy, or prolixity of evidence be avoided. A transcript shall be made of the informal hearing and is to be made available to the public.

The bill expressly provides that the standards setting hearings be conducted in accordance with the provisions of section 553 of title 5 of the United States Code and that the requirements of sections 556 and 557 of that title would not be applicable. The Committee believes that formal proceedings, involving trial-type hearings, based on full cross-examination of witnesses and credibility findings, with burden of proof requirements on the agency, are completely inappropriate to the development and promulgation of standards. Proceedings under section 553 would serve to avoid opportunities for confusion and delays in effectuating the Act's goals and, at the same time, provide an adequate means for the Secretary to obtain the information necessary to the development of standards to protect miners. However, it is anticipated, to insure fairness, that the Secretary will issue necessary rules to assure that all interested parties have ample opportunity to participate in these proceedings, including the right, limited by the need to avoid undue delays, to make oral presentations.

The bill authorizes the Secretary to subpoena witnesses and evidence which he believes relevant and necessary in connection with any rulemaking

608

20

activity under this section: While it is anticipated that, in most cases, the necessary information will be provided voluntarily, this provision is intended to assure that the Secretary has the means to obtain data which may otherwise not be forthcoming that would assist in the development of standards. The Committee notes that this subpoena power is discretionary. Any requirement that the Secretary is emphasis to subpoena

evidence before proceeding to issue a standard is inconsistent with the prompt, informal, legislative-type rulemaking hearings contemplated by this Act. The Secretary is, however, empowered to use subpoenas if he deems it necessary to responsible rulemaking.

Within 90 days of the certification of the hearing record (or of the close of the comment period if no hearing is requested), the Secretary is required to issue his final rule or to make a determination not to issue the proposed rule. Such rule or the Secretary's determination not to issue a rule must be published in the Federal Register with the reasons for such determination.

S. 717 eliminates the possibility of the lengthy standard promulgating procedures, which have too often been experienced under the current Coal and Metal Acts, by putting a closure date on the several steps of the process. Once the standard promulgation procedure begins, it is regulated within a specific statutory time frame. This procedure should facilitate more expeditious promulgation of standards. At the same time, however, the Committee realized that despite the exercise of good faith, the Secretary may in certain cases be unable to meet the time limitations. Failure to meet the time frames in such cases should not be grounds for challenging the validity of the standard.

The Committee recognizes that it may be necessary to delay the effective date of a mandatory health or safety standard where existing technology or apparatus is not available to meet a standard or in other appropriate circumstances. Sec. 102(a)(4)(D) permits the Secretary to delay the effective date only for such reasonable period as the secretary determines may be necessary to insure effective compliance.

Review of Standards

S. 717 provides for review of standards in the Circuit Court. The Committee intends that the procedures under this section shall be the exclusive means for testing the validity of standards and that the validity of standards shall not be subject to collateral attacks before the Commission or in other types of enforcement proceedings. The Committee believes that the proper time to raise objections to a standard is at the time that the standard is proposed and being promulgated, and it should be the duty of all concerned parties to insure the development of the most complete record within the administrative standards setting procedure.

While the right to participate in the judicial review process is not limited to those who participated in the administrative

standards setting process, the bill provides that objections that have not been urged in the administrative rulemaking proceedings may not be considered by the appeals court unless the failure or neglect to raise the objection is excused because of extraordinary circumstances.

609

21

Persons adversely affected by a standard must seek judicial review of the validity of such standard within sixty days after promulgation. By limiting the time within which judicial review of promulgated standards may be sought, it is intended to give maximum finality to mandatory standards once promulgated and thereby increase the certainty of the government's regulations.

In reviewing standards, the Committee intends the Court of Appeals to apply the arbitrary and capricious test, the criterion usually applied to rules issued in accordance with the procedures in section 553 of Title 5 of the United States Code. This test would require the reviewing court to scrutinize the Secretary's action to determine whether it was rational in light of the evidence before him and reasonably related to the law's purposes, and is, in the Committee's view, the appropriate test for judicial review of legislative-type proceedings involving policy judgments in areas where specific factual findings cannot always realistically be made.

Toxic materials and harmful physical agents

The bill also provides for the promulgation of standards dealing with toxic substances, and harmful physical agents. Section 102(a)(5)(A) of the bill requires that standards dealing with toxic materials and harmful physical agents shall most adequately assure, on the basis of the best available evidence, that no miner will suffer material impairment of health or functional capacity even if such miner has regular exposure to hazards dealt with by such standard for the period of his working life. The Secretary's authority under this section includes not only the promulgation of standards covering individual substances but also standards covering classes or groups of substances. The Committee believes that "generic" standards of this kind may often provide more effective protection to miners. The committee believes that the overriding consideration in setting health standards dealing with toxic substances and harmful physical agents must be the protection of the health of miners.

This section further provides that "other considerations" in the setting of health standards are "the latest available

scientific data in the field, the feasibility of the standards, and experience gained under this and other health and safety laws." While feasibility of the standard may be taken into consideration with respect to engineering controls, this factor should have a substantially less significant role. Thus, the Secretary may appropriately consider the state of the engineering art in industry at the time the standard is promulgated. However, as circuit courts of appeals have recognized, occupational safety and health statutes should be viewed as "technology-forcing" legislation, and a proposed health standard should not be rejected as infeasible "when the necessary technology looms on today's horizon". (AFL-CIO v. Brennan, 530 F. 2d 109) (CA 3 1975); Society of Plastics Industry v. OSHA, 509 F. 2d 1301 (CA 2) cert. den. 427 992 (1975).

Similarly, information on the economic impact of a health standard which is provided to the Secretary of Labor at a hearing or during the public comment period, may be given weight by the Secretary. In adopting the language of section 102(a) (5) (A), the Committee wishes to emphasize that it rejects the view that cost benefit ratios alone may be the basis for depriving miners of the health protection which the

610

22

law was intended to insure. The Committee concurs with the judicial constitution that standards may be economically feasible even though from the standpoint of employers, they are "financially burdensome and affect profit margins adversely" (I.U.D. v. Hodgson 499 F. 2d 647 (D.C. Cir. 1974)). Where substantial financial outlays are needed in order to allow industry to reach the permissible limits necessary to protect miners, other regulatory strategies are available to accommodate economic feasibility and health considerations. These strategies could include delaying implementation of certain provisions or requirements of standards in order to allow sufficient time for engineering controls to be put in place or a delay in the effective date of the standard.

Section 102(a) (5) (B) of the bill requires the Secretary of Health, Education and Welfare to study toxic materials or harmful physical agents found in mines and determine those which are potentially toxic at the concentrations in which they are used or found in a mine. The Secretary of HEW must submit a list of such determinations to the Secretary within 18 months from the date of enactment and on a continuing basis thereafter. As soon as possible after preparing the list, the Secretary of HEW must develop pertinent criteria regarding any such substances

determined to be toxic or any such physical agents and shall submit such to the Secretary as developed. Within 60 days of receipt of any such criteria, the Secretary must commence rulemaking proceedings for any toxic material or harmful physical agent not adequately covered by existing regulations, pursuant to the provisions of Sec. 102(a) or publish his determination not to do so.

Labels or other forms of warnings; medical examinations

Section 102(a)(6) of the bill requires that a standard that is promulgated must prescribe the use of labels or other appropriate forms of warning to insure, as necessary, that miners are apprised of all hazards to which they are exposed, relevant symptoms and appropriate emergency treatment, and proper conditions and precautions of safe use or exposure. While labels are useful in apprising miners of the hazards to which they are exposed, in many circumstances other forms of warning may be equally or more effective. It is not intended that labels be prescribed indiscriminately, because as labels proliferate, their effectiveness will be diminished. The Secretary, in determining the most effective means of apprising miners of hazards, should bear in mind the diminished effectiveness that may result from excess labelling, and should consider other means of informing miners of hazards, such as safety and health training or requiring periodic briefings of miners.

Section 102(a)(6) of the bill requires the Secretary to include in health standards, where appropriate, the requirement that miners be given periodic medical examinations. The Committee intends that the operator must bear the cost of providing such medical examinations or tests. Such medical examinations are intended to be for the benefit of miners, and are for the purpose both of testing the adequacy of the standard and testing whether the miner has been subjected to material impairment of health or functional capacity as a result of exposure to the substance or hazard. As such, the medical examinations are a key aspect of the health standards. To encourage miners to take such medical examinations, this section requires the Secretary to issue appropriate

611

23

standards requiring that miners who, as a result of these examinations, are determined to have suffered material impairment of health or functional capacity as a result of exposures be reassigned to positions where they will not be so exposed; and that they continue to receive compensation at no less than the

regular rate for miners in the classification such miner held immediately prior to transfer. This "regular rate" is to include any subsequent salary increase received by miners in the classification such miners held immediately prior to transfer. These requirements would be enforced through the issuance of appropriate citations, orders and penalties under sections 105 and 106. In addition, under section 106(c), it would be unlawful for an operator to discriminate against a miner who is the subject of medical examination and potential transfer under the provisions of a standard issued under this section.

Special standards making

S. 717 also makes provision for special standard promulgation to deal with situations resulting from the combination of existing laws into a single law and from extraordinary circumstances.

a. Existing mandatory standards.--Existing mandatory standards under both the Coal and the Metal Act are carried over and become mandatory standards under S. 717 until such time as they may be amended, modified or revoked by the Secretary. As is the case under the Coal Act, S. 717 requires that all new or revised standards promulgated by the Secretary must afford the same level of protection which is provided by current standards.

b. Existing advisory standards under the Metal Act.--Because advisory standards are inconsistent with the enforcement scheme envisioned by the bill, section 301(b) (2) of S. 717 provides a special procedure for study of the existing advisory standards under the Metal Act. Within 60 days of enactment, the Secretary shall establish an Advisory Committee to review the current advisory standards and to recommend, within 180 days, which of the advisory standards should be promulgated as new mandatory standards. A special abbreviated rulemaking procedure is provided for such promulgation. All health and safety standards contemplated by S. 717 are to be mandatory standards. The bill uses the phrase "mandatory health and safety standard" because this is a defined term under the Coal Act and this bill. The use of the term "mandatory standard" should not be interpreted to mean that there also will be non-mandatory standards.

c. Emergency temporary standards.--Section 102(b) of the bill authorizes the Secretary to issue emergency temporary standards in situations of grave danger to miners, without first going through the statutory rulemaking procedures. Three points concerning this provision bear emphasis.

First, this provision is designed to allow the Secretary to react quickly to grave dangers which threaten miners before those

dangers manifest themselves in serious or fatal injuries or illnesses. The Committee emphasizes that these provisions should not be interpreted as suggesting that a record of fatalities or serious injuries is necessary before an emergency temporary standard can be issued. Disasters, fatalities, and disabilities are the very things this provision is designed to prevent. The Committee, therefore intends that emergency

612

24

temporary standards should be issued under this section when the Secretary determines that miners are exposed to a working environment which contains dangers with the potential to threaten human life, health and safety and there is no adequate enforceable safety or health standard to protect them against that potential. Waiting until those dangers manifest themselves as fatalities or disabling injuries or illnesses, frustrates the purpose of the provision.

Second, this provision does not exclude any particular classes of grave dangers from those for which an emergency temporary standard is available. For example, it is intended that emergency temporary standards be issued in response to grave dangers that are of novel as well as of longstanding causes; or of dangers that result from conditions whose harmful potential has just been discovered, or from those to which large numbers of miners are being newly exposed. To exclude any kind of grave danger would contradict the basic purpose of emergency temporary standards--protecting miners from grave dangers. That a danger has gone unremedied should not be a bar to issuing an emergency standard. Indeed, if such is the case, the need for prompt action is that much more pressing.

Third, once the Secretary has identified a grave danger that threatens miners the Committee expects the Secretary to issue an emergency temporary standard as quickly as possible, not necessarily waiting until he can investigate how well that grave danger is being managed or controlled in particular mines.

The Committee fully realizes the serious nature of permitting the Secretary to issue an enforceable standard without hearings and other means of more precisely determining in advance the myriad ramifications of his actions. These provisions do not require the Secretary to prove the existence of a grave danger as a matter of record evidence prior to taking action, but permit him to take immediate action as a matter of preventive policy. In short, the Committee realizes the need to act quickly where,

in the judgment of the Secretary, a grave danger to miners exists. To strike a balance between these two considerations, the bill permits the emergency temporary standard to remain in effect for only tone months.

After the emergency temporary standard is issued, the Secretary shall initiate the rule making process pursuant to Sec. 102(a) in which all views can be carefully considered in connection with the issuance of a permanent standard.

(d) Safety and Health Standards for More Construction Workers.--The Committee recognizes that in some instances the health and safety standards applicable to mining operations may not adequately address the hazards faced by workers engaged in mine construction. For this reason, Section 102(a) (7) requires the Secretary, to the extent practicable, to promulgate standards which will apply to mine construction activity which takes place on the surface in a separate section of the regulations, so that mine construction workers and contractors and inspectors will have them available in one place for ready reference. These should include all mining standards which could be applicable to construction activity as well as other standards, such as OSHA standards, which may also be applicable to mine construction hazards. The requirement that standards be separately promulgated does not

613

25

relieve construction operators from complying with the requirements of the Act generally, including the general duty clause.

The Committee believes that construction workers engaged in underground construction are generally exposed to the same hazards as are underground miners. For this reason, the bill does not require the promulgation of separate standards for underground construction, as the Committee believes that it would be extraordinarily difficult for the Secretary to determine which of the mandatory health and safety standards applicable to underground mining activity would or would not apply to underground construction work as well.

The committee notes that in addition to mandatory standards applicable to all operators, operators are also subject to the requirement set out in the various mine by mine compliance plans required by statute or regulation. The requirements of these plans are enforceable as if they were mandatory standards. Such individually tailored plans, with a nucleus of commonly accepted

practices, are the best method of regulating such complex and potentially multifaceted problems as ventilation, roof control and the like. The Committee notes with approval that individual mine plan adoption and implementation procedures have been sustained by the federal Court of Appeals for the District of Columbia circuit (*Ziegler Coal Company v. Secretary of the Interior*, 536 F. 2d 398, (1976)). Thus, the Committee fully expects the individual mine plan technique to continue to be utilized by the Secretary in appropriate circumstances. The Committee cautions that while the operator proposes a plan and is entitled, as are the miners and representatives of miners to further consultation with the Secretary over revisions, the Secretary must independently exercise his judgment with respect to the content of such plans in connection with his final approval of the plan. The operator and the representative of miners are entitled to full and prompt judicial review of plan contents, under Section 102(f).

Variances from standards

S. 717 provides that, variances from existing standards may be granted by the Secretary in two circumstances:

- (1) A variance may be granted for the performance of research in connection with safety or health matters (Sec. 102(c)); and
- (2) a variance may be granted in cases where the Secretary finds that alternative means of performing the work exist which are as safe and healthful as would be afforded if the standard were in effect, or that the application of the standard at a particular mine would diminish the health or safety of the miners (Sec. 102(d)).

In all cases, it is the Committee's expectation that such variances not be granted unless the petitioner can clearly demonstrate that miners who work under such variances will be exposed to no greater risks than they would be exposed to had no such variance been granted. The Committee's intention is that in all such cases, the working conditions be no less safe and healthful than those contemplated by the standard. It is the Committee's intention that the affected miners and the public be notified of the Secretary's decision to grant research variances. It is further the Committee's intention that miners and their representatives be informed of the application for variances by appropriate means in addition to the requirement of publication in the

Federal Register and afforded an opportunity to participate fully in any proceeding which could result in the granting of a variance under Section 102(d), and provision is made that any interested party shall be afforded an opportunity for a public hearing on the issue. The language of Section 102(d) is based on Section 301(c) of the Coal Act, and it is the Committee's intention that variances will be granted under this section on a case-by-case, mine-by-mine basis. Section 102(e) also retains the prohibition on granting variances for the mandatory health standards promulgated under title II of the Coal Act prior to the effective date of this Act. However, variances may be granted for mandatory health standards promulgated after the effective date of this Act.

INSPECTIONS, INVESTIGATIONS, AND RECORDKEEPING

Purpose and advance notice

Frequent inspections and investigations are authorized under Section 104 for a variety of purposes, such as determining whether or not there is compliance with mandatory safety and health standards or with any requirement of the Act, including the general duty requirements of Section 101; and to assist the Secretary in developing improved standards or procedures. Moreover, it is important that, except for inspections by the Secretary of Health, Education, and Welfare, no advance notice of an inspection be given to any person.

Number of inspections

Section 104(a) would require that the Secretary of Labor conduct at least four inspections a year of each underground mine in its entirety and two inspections a year of each surface mine in its entirety. The present Coal Act requires a minimum of four such inspections per year of underground mines and the Metal Act requires only one such inspection annually. While this provision sets a minimum number of inspections, the Committee notes that the bill also requires the Secretary to increase the number of inspections required based on guidelines which he develops. It is expected that should the Secretary require additional resources to meet this inspection burden, such re- sources would be made available through the normal appropriations process.

The bill also authorizes the Secretary to establish special inspection schedules for mines which liberate more than 200,000 cubic feet of methane or other explosive gases per day.

The Department of the Interior, under the Coal Act, administratively defined "excessive quantities" of explosive

gases as one million cubic feet liberated with a twenty-four hour period, which, at this time, includes 57 mines. During consideration of S. 1302 in the 94th Congress, the Committee discussed whether this administrative definition subjected a sufficient number of mines to the more frequent inspection schedule. It was noted, for instance, that the Scotia Mine, which liberated about 240,000 cubic feet of methane per day, was not, under the Department's guidelines, subject to the more frequent inspection requirements of this section, despite the fact that that mine was the gassiest mine in the district in which it was located.

615

27

The provision in Sec. 104(h) requires inspection once each ten days of mines liberating 500,000 cubic feet of such gasses per day, which is consistent with current MESA administrative practices; and inspection once each 15 days for mines liberating 200,000 cubic feet of such gasses per day. The Committee believes strongly that such measures will insure that mines which liberate more than 200,000 cubic feet of methane or other explosive gasses during a twenty-four hour period are given adequate attention and impose a reasonable inspection burden on the Secretary. These mines must be inspected frequently enough to insure that explosions such as the ones which occurred at the Scotia Mine can be averted through assiduous inspection.

Right of entry

Section 104(a) authorizes the Secretary of Labor and the Secretary of Health, Education, and Welfare to enter upon, or through any mine for the purpose of making any inspection or investigation under this Act. This is intended to be an absolute right of entry without need to obtain a warrant. The Committee notes with approval the decision of the three-judge Federal Court in *Youghiogeny & Ohio Coal Company v. Morton*, 364 F. Supp. 45 (S.D. Ohio 1973) which holds the parallel provision of the Coal Act permitting unannounced warrantless inspection of coal mines constitutional. Safety conditions in the mining industry have been pervasively regulated by Federal and State law. The Committee intends to grant a broad right-of-entry to the Secretaries or their authorized representatives to make inspections and investigations of all mines under this Act without first obtaining a warrant. This intention is based upon the determination by legislation. The Committee notes that despite the progress made in improving the working conditions of the nation's miners under present regulatory authority, mining continues to be one of the nation's most hazardous occupations.

Indeed, in view of the notorious ease with which many safety or health hazards may be concealed if advance warning of inspection is obtained, a warrant requirement would seriously undercut this Act's objectives.

The Committee has specifically adopted the prohibition on advance notice of inspections which is currently the rule under the Coal Act, and rejects the provision of the Metal Act which permits such advance notice.

Taking of testimony

Section 104(b) gives to the Secretary of Labor the authority to issue subpoenas for the attendance and testimony of witnesses and the production of evidence under oath. This authority is limited to investigations, and not inspections. Implicit in the authority to require testimony and the production of evidence under oath is the authority for the Secretary of Labor or his authorized representative to administer oaths for purposes of this provision.

Recordkeeping

The bill in Section 104(c)(1) gives the Secretaries broad authority to prescribe recordkeeping requirements which are necessary to the enforcement of the Act or for developing improved safety and health standards.

616

28

A concurrent right of access by the Secretaries to these records is also given. Regulations may additionally require operators to themselves conduct periodic inspections of mines, to include, but not, limited to firebossing, preshaft inspections, or methane and dust monitoring.

Section 104(c)(4) of the bill contains separate requirements concerning the re- porting, recording and investigating of accidents and of death or injuries. Such investigations shall be made and records kept whether or not the accident results in injury or death. Every accident must be investigated by an operator both to determine its cause and to ascertain the means to prevent recurrence. This provision reasserts the Committee's view that the primary responsibility for mine safety and health is the operator's and requires the operator to maintain a continuing program for mine safety and health. Such accidents may forwarn mine operators of potential hazards, and they should thus be investigated, and remedial action should be taken

regardless of whether actual injuries occurred. The operator is required to keep a record of his actions to prevent recurrence of similar accidents. These records are available for inspection by interested persons.

Section 104(d) provides that the Secretary, in promulgating regulations regarding the keeping of records, and in other means of obtaining information, do so in a manner which minimizes the burden on operators consistent with his need to efficiently and effectively perform his enforcement responsibilities. It is the Committee's intention, however, that in trying to minimize the record keeping burden on operators, the Secretary bear in mind that the primary objective of the Act is the assurance of the health and safety of miners. The bill therefore places this requirement on the Secretary, and the Secretary's determinations are to be final. In this respect, the Committee recognizes that adequate investigation of accidents by operators assists operators to develop responsive and responsible in-house safety and health programs. Further, it is not the intention of the Committee to distinguish mines by their size with respect to the applicability or enforcement of mandatory health and safety standards.

The right of miners and miners' representatives to accompany inspectors

Section 104(e) contains a provision based on that in the Coal Act, requiring that representatives of the operator and miners be permitted to accompany inspectors in order to assist in conducting a full inspection. It is not intended, however, that the absence of such participation vitiate any citations and penalties issued as a result of an inspection. The opportunity to participate in pre-or post-inspection conferences has also been provided. Presence of a representative of miners at opening conference helps miners to know what the concerns and focus of the inspector will be, and attendance at closing conference will enable miners to be fully apprised of the results of the inspection. It is the Committee's view that such participation will enable miners to understand the safety and health requirements of the Act and will enhance miner safety and health awareness. To encourage such miner participation it is the Committee's intention that the miner who participates in such inspection and conferences be fully compensated by the operator for time thus spent. To provide for other than full compensation would be inconsistent with the purpose of the Act and would

unfairly penalize the miner for assisting the inspector in performing his duties. The Committee also recognizes that in some circumstances, the miners, the operator or the inspector may benefit from the participation of more than one representative of miners in such inspection or conferences, and this section authorizes the inspector to permit additional representatives to participate.

Accidents

The unpredictability of accidents in mines and uncertainty as to the circumstances surrounding them requires that the Secretary or his authorized representative be permitted to exercise broad discretion in order to protect the life or to insure the safety of any person. The grant of authority in Section 104(i) to take appropriate actions and in Section 104(j) to issue orders is intended to provide the Secretary with flexibility in responding to accident situations, including the issuance of withdrawal orders. Further, the circumstances surrounding the accident may be such that an order necessary to preserve evidence may be appropriate. It is intended that by preventing possible destruction of evidence, the Secretary may be better able to determine the cause of the accident and thereby prevent the future occurrence of a similar accident.

Inspection on the request of miners

S. 717 carries over an important right granted to miners under the Coal Act, the right to request inspections by the Secretary of mines which the miners have reasonable grounds to believe to be dangerous. The provision, Section 104(f) (1) expands the protection which is currently offered only to representatives of miners under the Coal Act. The provision makes clear that any representative of miners, or any individual miner may request such an inspection. Such requests must be in writing, signed by the miner or miners' representative, and must specify the alleged violation or imminent danger situation which is believed to exist. Under this provision the Secretary shall conduct an inspection upon receipt of such a request, and serve upon the mine operator a copy of the request no later than the time of inspection. The Committee is aware of the need to protect miners against possible discrimination because they file complaints, and accordingly, the Section requires that the name of the person filing the complaint and the names of any miners referred to in the complaint not appear on the copy of the complaint which is served on the mine operator. While other provisions of the bill carefully protect miners who are discriminated against because they exercise their rights under the Act, the Committee feels

that strict confidentiality of complainants under Section 104(f) (1) is absolutely essential.

To assure that complaints are being responded to, the section requires that upon completion of any inspection and determination that the violation or danger alleged does not exist, the Secretary must inform the complainant.

While Section 104(f) (1) requires that such complaints be written, and signed by the complaining party, the Committee does not intend to preclude the Secretary's response to unwritten or unsigned complaints. The Committee notes that MESA currently maintains an inward WATS line (an "800" number) for the express purpose of receiving

618

30

complaints about hazardous conditions in mines. The Secretary must respond to appropriate complaints under Section 104(f) (1), but he need not necessarily follow up on complaints that do not meet the requirements of that section.

Finally, Section 104(f) (2) permits miners or their representatives to notify inspectors of suspected violations or hazards which they believe may exist in the mine while the inspector is at the mine premises.

Both of these provisions are based on the Committee's firm belief that mine safety and health will generally improve to the extent that miners themselves are aware of mining hazards and play an integral part in the enforcement of the mine safety and health standards.

Citations and orders

Section 105(a) provides that if, upon inspection or investigation the Secretary or his representative believes an operator has violated this Act or any standard, rule, order or regulation promulgated pursuant to this Act, he shall with reasonable promptness issue a citation to the operator. There may be occasions where a citation will be delayed because of the complexity of issues raised by the violations, because of a protracted accident investigation, or for other legitimate reasons. For this reason, section 105(a) provides that the issuance of a citation with reasonable promptness is not a jurisdictional prerequisite to any enforcement action. Citations shall describe with particularity the nature of the violation, and fix a reasonable time for the violation's

abatement.

The Committee believe that rapid abatement of violations is essential for the protection of miners. A violation of a standard which continues unabated constitutes a potential threat to the health and safety of miners. Therefore, if the violation is not eliminated by abatement in the specified period of time, the miners should be with-drawn from the area affected by the violation until the violation is abated. Section 105(b) provides the Secretary with such authority upon a determination that the violation has not been totally abated within the original or subsequently extended abatement period, and that the abatement period should not be further extended.

The Committee intends that withdrawal orders shall be issued when there has been a failure to abate violations within the time specified in the citation. A withdrawal order is properly issued under this section if an inspector finds during the same or subsequent inspection of the mine that an operator has failed to abate a violation. For example, if a citation is issued with an abatement period of one hour, and the violation is not abated in that time, the authorized representative shall issue a withdrawal order under this section when he follows-up on the citation, whether such follow-up is on the same or a subsequent inspection.

Operators may seek Commission review of such withdrawal orders for failure to abate under section 106. In the case of failure to abate pursuant to the requirements of a citation, the Secretary may propose daily penalties of up to \$1,000 per day under section 111(b).

Unwarranted failure closure orders

Section 105(c) contains another sanction, carried over from the Coal Act but not present in the Metal Act; the unwarranted failure

619

31

closure order. Like the failure to abate closure order of section 105(b), the unwarranted failure order recognizes that the law should not tolerate miners continuing to work in the face of hazards resulting from conditions violative of the Act which the operator knew of or should have known of and had not corrected.

The "unwarrantable failure" remedy first found its way into coal mine safety law with the Federal Coal Mine Safety Act Amendments of 1965.

The current Coal Act continues this provision in Section 104(c) which provides that where an inspector finds a violation which, while not causing imminent danger, could "significantly and substantially contribute to the cause and effect of a mine safety and health hazard" (the so-called "gravity" test), and where the violation was the result of the operator's "unwarrantable failure" to comply with the Act, the inspector shall so note such findings in his notice of violations. The section further provides that if within the same or a subsequent inspection within 90 days the inspector finds "another violation of any mandatory * * * standard and finds such violation to be also caused by an unwarrantable failure of such operator to so comply", then the inspector shall issue an order requiring all miners to be removed from the affected area. When an order has been issued pursuant to Section 104(c) (1), and subsequent inspection which reveals "the existence in such mine of violations similar to those which [triggered the 104(c) (1) ordered]", the inspector shall promptly issue a withdrawal order under Section 104(c) (2) on each such occurrence until an inspection of the mine in its entirety shows "no similar violations."

The Interior Board of Mine Operations Appeals has until recently taken an unnecessarily and improperly strict view of the "gravity test" and has required that the violation be so serious as to very closely approach a situation of "imminent danger", Eastern Associated Coal Corporation, 3 IBMA 331 (1974).

The Committee notes with approval that the Board of Mine Operations Appeals has reinterpreted the "significant and substantial" language in Alabama By-Products Corp., 7 IBMA 85, and ruled that only notices for purely technical violations could not be issued under Sec. 104(c) (1).

The Board there held that "an inspector need not find a risk of serious bodily harm, let alone death" in order to issue a notice under Section 104(c) (1).

The Board's holding in Alabama By-Products Corporation is consistent with the Committee's intention that the unwarranted failure citation is appropriately used for all violations, whether or not they create a hazard which poses a danger to miners as long as they are not of a purely technical nature. The Committee assumes, however, that when "technical" violations do pose a health or safety danger to miners, and are the result of an "unwarranted failure" the unwarranted failure notice will be issued.

The other decisional limitation on the use of this sanction has

been the rather narrow interpretation of the term "unwarrantable failure".

The Board has recently reinterpreted the phrase "unwarrantable failure to comply" to mean "the failure of an operator to abate a condition or practice constituting a violation of a mandatory standard

620

32

it knew or should have known existed, or the failure to abate such a condition or practice because of indifference or lack of reasonable care." Ziegler Coal Co., 7 IBMA 280.

The Committee approves the recent decision of the Board of Mine Operations Appeals in Ziegler Coal Co. which liberalized the interpretation of the term "unwarrantable failure."

Finally, Section 104(c) (2) of the Coal Act provides that, the inspection which permits the operator to revert back to Section 104(c) (1) must disclose no "similar" violations. MESA has enforced this provision to require that the inspection must disclose no "unwarrantable" violations, whether or not the violations found are substantively similar to the violation upon which the order or notice was based. This is consistent with the Committee's intention, and Section 105(c) (2) of S. 717 has clarified this language to specifically state that the inspection shall disclose no "unwarranted violations."

These decisions have considerably restored the unwarrantable failure closure order as an effective and viable enforcement sanction, and it is for that reason that S. 717 retains this sanction in essentially the same form in Sec. 105(c).

Pattern of violations

Section 105(d) provides a new sanction which requires the issuance of a withdrawal order to an operator who has an established pattern of health and safety violations which are of such a nature as could significantly and substantially contribute to the cause and effect of mine health and safety hazards. The need for such a provision was forcefully demonstrated during the investigation by the Subcommittee on Labor of the Scotia mine disaster which occurred in March 1976 in Eastern Kentucky. That investigation showed that the Scotia mine, as well as other mines, had an inspection history of recurrent violations, some of which were tragically related to the disasters, which the existing enforcement scheme was unable to address. The

Committee's intention is to provide an effective enforcement tool to protect miners when the operator demonstrates his disregard for the health and safety of miners through an established pattern of violations.

Section 105(d)(1) provides that if the compliance record of the operator demonstrates a pattern of violation of health or safety standards which are of a "significant and substantial" nature, he shall be given written notice that such pattern exists. This notice advises the operator of the determination that a pattern exists, and that if, upon any inspection within 90 days after the issuance of notice, any violation of a standard which is also of a "significant and substantial" nature is found, an order of withdrawal will be issued.

The withdrawal order will remain in effect until it has been determined that the violation which resulted in the order has been abated.

Once a withdrawal order has been issued under section 105(d)(1), and a subsequent inspection of the mine discloses another violation of a nature which could significantly and substantially contribute to the cause and effect of a safety or health hazard, a withdrawal order shall be issued under Section 105(d)(2), and such order shall remain in effect until the violation which gave rise to the order has been abated. Subsequent to this, the operator is subject to the issuance of further 105(d)(2) withdrawal orders until an inspection of the mine in its

621

33

entirety discloses no violations of any safety and health standards which could significantly and substantially contribute to the cause and effect of a mine health or safety hazard. (Section 105(d)(3)).

This sequence parallels the current unwarrantable failure sequence of the Coal Act, and the unwarranted failure sequence of Section 105(c) of the bill. The Committee believes that this additional sequence and closure sanction is necessary to deal with continuing violations of the Act's standards. The Committee views the 105(d)(1) notice as indicating to both the mine operator and the Secretary that there exists at that mine a serious safety and health management problem, one which permits continued violations of safety and health standards. The existence of such a pattern, should signal to both the operator and the Secretary that there is a need to restore the mine to

effective safe and healthful conditions and that the mere abatement of violations as they are cited is insufficient.

It is the Committee's intention to grant the Secretary in Section 105(d)(4) broad discretion in establishing criteria for determining when a pattern of violations exists.

The Secretary's criteria will necessarily have to be broad enough to encompass the varied mining activities within the Act's coverage. The Committee intends that the criteria make clear that a pattern may be established by violations of different standards, as well as by violations of a particular standards. Moreover, while the Committee considers that a pattern is more than an isolated violation, pattern does not necessarily mean a prescribed number of violations of predetermined standards nor does it pre-suppose any element of intent or state of mind of the operator. As experience with this provision increases, the Secretary may find it necessary to modify the criteria, and the Committee intends that the Secretary continually evaluate the criteria for this purpose.

Comparison of Section 105(c) and 105(d)

The violation which sets into motion the enforcement sequence under Section 105(c) must be of a "significant and substantial" nature and must be the result of the operator's "unwarranted failure" to comply. Under Section 105(d) there is no requirement that the violations establishing the pattern of offense be a result of the operator's "unwarranted failure", only that they be of a "significant and substantial" nature. The meaning of "significant and substantial" as established under Section 105(c) should also apply in Section 105(d).

Section 105(c)(1) provides that a citation for a violation is issued to the operator. Under Section 105(d)(1), the operator is given a notice of the fact that the pattern of violations has been established. The purpose of the notice is to advise the operator that the next violation of a "significant and substantial" nature will result in the issuance of an order. Both subsections contain a 90 day period after the issuance of the citation or notice within which the order must be covered to establish the sequence.

The order under Section 105(c)(1) or 105(c)(2) is based upon a determination that the violation was due to the operator's "unwarranted failure" to comply. However, under Section 105(d)(1) or 105(d)(2) the order is issued if the violation was of a "significant

and substantial" nature, irrespective of whether the violation was the result of an "unwarranted failure" to comply.

Both Sections 105(c) and 105(d) require an inspection of the mine in its entirety in order to break the sequence of the issuance of orders. However, Section 105(c) requires that the inspection must reveal no "unwarranted" violations, and under Section 105(d) the inspection must reveal no violations of a "significant and substantial" nature.

It is the Committee's intention that the Secretary or his authorized representative may have both enforcement tools available, and that they can be used simultaneously if the situation warrants. For example, where an operator has been given a Section 105(c) citation and a Section 105(d) notice, and thereafter an inspection discloses a violation of a "significant and substantial" nature and which is also "unwarranted", the operator will be issued both an order under Section 105(c) and an order under Section 105(d). The requirements to break the sequence in Sections 105(c) and 105(d) differ, and are intended to be satisfied individually.

Enforcement Procedure

The procedure for enforcement of the Act is based upon the procedure under the Coal Act. After an inspection, the Secretary shall within a reasonable time serve the operator by certified mail with the proposed penalty to be assessed for any violations. The bill requires that the representative of miners at the mine also be served with the penalty proposal. To promote fairness to operators and miners and encourage improved mine safety and health generally, such penalty proposals must be forwarded to the operator and miner representative promptly. The Committee notes, however, that there may be circumstances, although rare, when prompt proposal of a penalty may not be possible, and the Committee does not expect that the failure to propose a penalty with promptness shall vitiate any proposed penalty proceeding.

Section 106(a) requires that unless a proposed penalty is contested to the Commission within fifteen working days of receipt by the operator, the Secretary's proposed penalty shall become the final order of the Commission and shall not be reviewable by any court. Such final orders shall be enforceable or collectable in any court under the provisions of the Act. The Committee believes that requiring that individuals who intend to contest a proposed penalty assessment to do so promptly furthers the objective of the Act. Penalty matters should be finally

determined as quickly as possible. The Committee notes that contestants are required under this provision to notify the Commission of their intention to contest penalty proposals within fifteen days, and that the Commission would then subsequently schedule such matters for hearing before an Administrative Law Judge. For this reason, the Committee does not believe that fifteen days is an unreasonably short period of time to expect a contestant to so notify the Commission.

Section 106(b) indicates that the Secretary is to similarly notify operators and miners' representatives when he believes that an operator has failed to abate a violation within the specified abatement period. In most cases, a failure to abate closure order will have been issued pursuant to Section 105(b). The notice of proposed penalty to operators in such cases shall state that a 105(b) order has been issued and

623

35

the penalty provided by Section 111(b) of the Act shall also be proposed. This penalty shall be proposed in addition to the penalty for the underlying violation required by Section 111(a) of the Act.

The time limitations for notifying the Commission of the intent to contest penalty proposals set forth in Section 106(a) shall apply in these cases. While there is no provision for temporary or interim relief from abatement requirements generally, Section 106(b) does authorize the Commission, under certain circumstances designed to assure that the health and safety of miners shall not be threatened, to grant limited or temporary relief from further abatement requirements once the initial abatement period has run and a failure to abate closure order has been issued under Section 105(b).

Protection of miners against discrimination

If our national mine safety and health program is to be truly effective, miners will have to play an active part in the enforcement of the Act. The Committee is cognizant that if miners are to be encouraged to be active in matters of safety and health, they must be protected against any possible discrimination which they might suffer as a result of their participation. The Committee is also aware that mining often takes place in remote sections of the country, and in places where work in the mines offers the only real employment opportunity.

Section 106(c) of the bill prohibits any discrimination against a miner for exercising any right under the Act. It should also be noted that the class protected is expanded from the current Coal Act. The prohibition against discrimination applies to miners, applicants for employment, and the miners' representatives. The Committee intends that the scope of the protected activities be broadly interpreted by the Secretary, and intends it to include not only the filing of complaints seeking inspection under Section 104(f) or the participation in mine inspections under Section 104(e), but also the refusal to work in conditions which are believed to be unsafe or unhealthful and the refusal to comply with orders which are violative of the Act or any standard promulgated thereunder, or the participation by a miner or his representative in any administrative and judicial proceeding under the Act.

The legislation protects a miner from discrimination because he "is the subject of medical evaluation and potential transfer under a standard published pursuant to section 102." Under section 102, standards promulgated by the Secretary must provide; as appropriate, that where it is determined as a result of a physical examination that a miner may suffer material impairment of health or functional capacity by reason of his exposure to a hazard covered by a standard, the miner shall be removed from such exposure and reassigned; and that the miner transferred shall continue to receive compensation for his work at no less than the regular rate of pay for miners in the classification the miner held prior to transfer. The Committee intends section 106(c) to bar, as discriminatory, the termination or laying-off of a miner in such circumstances, or his transfer to another position with compensation at less than the regular rate of pay for the classification held by the miner prior to transfer. The relief provided under section 106(c) is in addition to that provided under sections 105(a) and (b) and 106 for violations of standards.

624

36

The listing of protected rights contained in section 106(c)(1) is intended to be illustrative and not exclusive. The wording of section 106(c) is broader than the counterpart language in section 110 of the Coal Act and the Committee intends section 106(c) to be construed expansively to assure that miners will not be inhibited in any way in exercising any rights afforded by the legislation. This section is intended to give miners, their representatives, and applicants, the right to refuse to work in conditions they believe to be unsafe or unhealthful and to refuse to comply if their employers order them to violate a safety and

health standard promulgated under the law. The Committee intends to insure the continuing vitality of the various judicial interpretations of section 110 of the Coal Act which are consistent with the broad protections of the bill's provisions; See, e.g., Phillips v. IBMA, 500 F. 2d 772; Munsey v. Morton, 507 F. 2d 1202. The Committee also intends to cover within the ambit of this protection any discrimination against a miner which is the result of the safety training provisions of Section 116 or the enforcement of those provisions under Section 105(f).

Whenever protected activity is in any manner a contributing factor to the retaliatory conduct, a finding of discrimination should be made.

It is the Committee's intention to protect miners against not only the common forms of discrimination, such as discharge, suspension, demotion, reduction in benefits, vacation, bonuses and rates of pay, or changes in pay and hours of work, but also against the more subtle forms of interference, such as promises of benefit or threats of reprisal. It should be emphasized that the prohibition against discrimination applies not only to the operator but to any other person directly or indirectly involved.

The bill requires the Secretary to rigorously enforce these rights with discrimination complaints receiving high priority.

The bill provides that a miner may, within 60 days after a violation occurs, file a complaint with the Secretary. While this time-limit is necessary to avoid stale claims being brought, it should not be construed strictly where the filing of a complaint is delayed under justifiable circumstances. Circumstances which could warrant the extension of the time-limit would include a case where the miner within the 60 day period brings the complaint to the attention of another agency or to his employer, or the miner fails to meet the time limit because he is misled as to or misunderstands his rights under the Act.

The Secretary must initiate his investigation within 15 days of receipt of the complaint, and immediately file a complaint with the Commission, if he determines that a violation has occurred. The Secretary is also required under section 106(c) (3) to notify the complainant within 90 days whether a violation has occurred. It should be emphasized, however, that these time-frames are not intended to be jurisdictional. The failure to meet any of them should not result in the dismissal of the discrimination proceedings; the complainant should not be prejudiced because of the failure of the Government to meet its time obligations.

The Secretary's investigation of matters alleged in the

complaint must commence within fifteen days of receipt of the complaint. Upon determining that the complaint appears to have merit, the Secretary

625

37

shall seek an order of the Commission temporarily reinstating the complaining miner pending final outcome of the investigation and complaint. The Committee feels that this temporary reinstatement is an essential protection for complaining miners who may not be in the financial position to suffer even a short period of unemployment or reduced income pending the resolution of the discrimination complaint. To further expedite the handling of these cases, the section requires that upon completion of the investigation and determination that the provisions of this section have been violated, the Secretary must immediately petition the Commission for appropriate relief.

In proceedings before the Commission brought by the Secretary, miner, applicants, or their representatives, may present additional evidence in their own behalf. In addition, under section 106(c) (3), if the Secretary determines that no violation has occurred, the complainant has the right within 30 days of receipt of the Secretary's determination, to file an action on his own behalf before the Commission. If the Secretary has provided a procedure for the miner to appeal a negative determination within the Department of Labor, the thirty-day period will not commence until such appeal procedures have been exhausted. Further, as mentioned above in connection with the time for filing complaints, this thirty-day limitation may be waived by the court in appropriate circumstances for excusable failure to meet the requirement. The Committee also intends to afford a complainant the right to institute an action on his own behalf before the Commission if the Secretary, in the exercise of his discretion, settles a case brought under section 106(c) (2) on terms unsatisfactory to the complainant.

It is the Committee's intention that the Secretary propose, and that the Commission require, all relief that is necessary to make the complaining party whole and to remove the deleterious effects of the discriminatory conduct including, but not limited to reinstatement with full seniority rights, back-pay with interest, and recompense for any special damages sustained as a result of the discrimination. The specified relief is only illustrative. Thus, for example, where appropriate, the Commission should issue broad cease and desist orders and include requirements for the posting of notices by the operator.

Procedure to counteract dangerous conditions

Section 108(a) provides that, if upon any inspection or investigation, the Secretary's representative finds an imminent danger exists, he shall determine the affected area and issue a withdrawal order barring all persons except those referred to in section 105(b) from such area. The issuance of an order under this subsection shall not preclude the issuance of a citation under section 105 or the proposing of a penalty under section 111. A section 108 order shall be issued whenever an inspector "finds that conditions or practices in such mine are such that an imminent danger exists . . .," and the withdrawal order shall not be lifted until "the conditions and practices which caused such imminent danger no longer exist." If miners are to receive the continuing protection that Congress intends inspectors and operators must look to the underlying conditions and practices causing an imminent danger. Section 108(a) thus requires the operator to correct the root causes as well as the symptoms of mine health and safety problems which give rise to the order.

626

38

The Committee disavows any notion that imminent danger can be defined in terms of a percentage of probability that an accident will happen; rather the concept of imminent danger requires an examination of the potential of the risk to cause serious physical harm at any time. It is the Committee's view that the authority under this section is essential to the protection of miners and should be construed expansively by inspectors and the Commission. Since we are dealing with situations where there is an immediate danger of death or serious physical harm. The Committee intends that the Act give the necessary authority for the taking of action to remove miners from risk. The Committee points out that, although imminent danger closure orders are subject to review by the Commission (as are all closure orders), Section 108(e) provides that no temporary relief may be granted by the Commission from the issuance of such an order. This limitation on the review authority of the Commission in this respect does not suggest a limitation on the inspector's authority to issue such orders, but rather is consistent with the importance of the imminent danger order as a means of protecting miners.

The imminent danger withdrawal order is designed to afford miners immediate protection in those situations where a condition or practice in a mine could reasonably be expected to cause death or serious physical harm before such condition or practice can be abated. Since the danger is imminent, the Committee recognizes

that the withdrawal order should specify that miners must be withdrawn immediately.

Section 108(c) requires findings and orders issued under section 108 (a) to contain a detailed description of the conditions which constitute an imminent danger, and that all orders issued under this section contain a description of the area of the mine throughout which persons must be withdrawn. The Committee recognizes that the purpose of the detailed description of conditions is to adequately apprise the operator of the problem involved so that he may take appropriate steps to correct the condition or practice. The Committee does not intend that this requirement be a procedural pitfall for the inspector, thus should it not be construed to invalidate orders issued under this section.

Section 108(d) requires that each finding made and order issued under this section be in writing, signed by the person making them, and given promptly to the affected operator. Any order issued pursuant to section 108(a) or (b) may be modified or terminated by the Secretary's representative. Any order issued under sections 108(a) or (b) shall remain in effect until terminated by the Secretary or modified or vacated by the Commission or the courts pursuant to sections 107(a) or 108(e).

Section 108(e) provides the mechanism by which any operator notified of an order under this section or any miner or representative notified of the issuance, modification, or termination of such an order may apply to the Commission for reinstatement, modification or vacation of that order and requires that the Commission take appropriate action to expedite proceedings.

Injunctions

Section 109(a) (1) enables the Secretary to seek court assistance to prevent activities by operators or other persons which interfere with,

627

39

hinder, or delay the Secretary or his authorized representative in the performance of their duties under the Act. Section 109(a) (2) creates a new enforcement tool: an injunctive-type remedy to close mines where there have been habitual violations. This provision is designed to enable the Secretary to deal with the

habitual or chronic violator of the Act; the operator who has demonstrated over a period of time that other available enforcement tools will not encourage his compliance with the spirit and the letter of the mine safety and health law.

The history of chronic violations of the standards under the 1969 Coal Act, already alluded to in this report, caused various members of the joint Senate-House panel investigating the Scotia disaster to inquire about why the mine could not be closed as a result of the habitual violations. The narrow reading of the "unwarrantable failure" sanction made that possibility unavailable, and MESA and Department of the Interior witnesses before the joint panel testified that there were no statutory provisions available which could justify a closure order for such a situation.

Section 109 of the bill provides a new enforcement sanction which is designed to meet this situation. The section provides that the Secretary may seek in the District Court appropriate relief, including injunctive relief, where the Secretary believes that the operator of a mine "is engaged in a pattern of violation of the health and safety standards of this Act which in the judgment of the Secretary constitutes a continuing hazard to the health or safety of miners." Section 109(b) provides that the Court shall fashion an appropriate remedy for such situations, including "such assurance or affirmative steps as it deems necessary to assure itself that the protection afforded to miners under this Act shall be provided by the operator."

The current scheme for enforcing the mine safety laws enables MESA to eliminate the dangerous conditions which are observed in the course of inspections, either by requiring the abatement of the violation or, where warranted, by withdrawing miners from the dangerous situation. Having taken these steps, however, there are no current enforcement sanctions to insure continued compliance with the Act's requirements by the operator after the abatement of the actual violations observed. The assessment and collection of civil penalties is intended to encourage a state of constant compliance with the Act on the part of operators, but as noted, the penalty system has been solely deficient in meeting this objective.

The new provision of Section 109 of the bill is designed to deal with this gap in enforcement. It is in essence, a means by which the Secretary can obtain the correction of violations which habitually occur when the inspector is not present in the mine. The provision enables the court to infer from the repeated discovery of violations at a mine that the operator of that mine probably regularly permits such violations to occur at times when the inspector is not present at the mine. When the court can

make this inference and can find that such constitutes a continuing hazard to the miners' health and safety, the provision gives the court the authority to fashion such remedy as it deems fit to insure that such situation does not continue to occur at that mine.

It is expected that the Secretary shall be able to rely on the violation history of a mine, as demonstrated by previous inspections, and such

628

40

other evidence as the Secretary shall have to show the suspected tendency of the operator in seeking relief under the section. MESA has been particularly deficient in the past in using such violation histories as a means of making inspections more responsive to the demonstrated problems at the mine inspected. It is the Committee's expectation that this provision will encourage the accumulation and routine use of violation history as an aid to inspectors in routine mine inspection.

The Committee notes that the injunctive authority for patterns and practices of violations is similar to the pattern of violation closure order sequence provided in section 105(d). It is the Committee's intent that this injunctive remedy provide further flexibility to the Secretary to deal with habitual violators of the Act beyond the remedy available under Section 105(d). For example, in an injunction case, the Court could exercise its authority to cover a wide range of affirmative corrective measures, and the refusal to comply with the order of the Court could be punishable as criminal or civil contempt.

Judicial review of Commission actions

The bill provides procedures for review or enforcement of final orders of the Commission, both with respect to withdrawal orders and penalty assessments by the United States Circuit Courts of Appeals as will be explained more fully, infra, such reviews or enforcement actions are to be record reviews, and the determinations of the Commission shall be affirmed by the court if supported by substantial evidence on the record as a whole. Consistent with the Committee's intention that penalty litigation move with no undue delay, interested parties must seek review of Commission orders within thirty days of such orders, and if no petition for review is filed within that time, the Secretary should file an action for collection in the District Court order section 111(k), or may seek enforcement of the Commission's order. The Secretary may also seek review of the final orders of

the Commission.

Courts may grant temporary relief from any final order of the Commission in circumstances where the temporary relief will not adversely affect the health and safety of miners. The Committee firmly believes that assuring the safety and health of miners shall be the primary consideration in connection with any proceeding for temporary relief from a closure order or abatement requirement.

Penalties

Civil penalties are not a part of the enforcement scheme of the Metal Act, but they have been part of the enforcement of the Coal Act since its enactment in 1969. The purpose of such civil penalties, of course, is not to raise revenues for the federal treasury, but rather, is a recognition that:

[s]ince the basic business judgments which dictate the method of operation of a coal mine are made directly or indirectly by persons at various levels of corporate structure, [the provision for assessment of civil penalties is] necessary to place the responsibility for compliance with the Act and the regulations, as well as the liability for violations on those who control or supervise the operation of coal mines as well as on those who operate them.

629

41

(S. Rep. 91-411, Federal Coal Mine Health and Safety Act of 1969, 91st Cong. 1st Session, p. 39.) In short, the purpose of a civil penalty is to induce those officials responsible for the operation of a mine to comply with the Act and its standards.

The Committee specifically rejects the suggestion that the imposition of civil penalties be discretionary rather than mandatory. A cursory glance at the relative improvements in rates of fatal and serious non-fatal occurrences in the coal industry (where civil penalties have been mandatory since 1970) versus the non-coal segment of the industry (where there currently is no provision for civil penalties, mandatory or permissive) (See Table 1, supra) suggests clearly that even if the civil penalty system under the Coal Act has not been totally effective in implementation, the presence of the civil penalty sanction has resulted in substantial improvements which are not noted in the non-coal segment of the industry under the Metal

Act.

For this reason the Committee has adopted the civil penalties as they exist in the current Coal Act.

To be successful in the objective of including effective and meaningful compliance, a penalty should be of an amount which is sufficient to make it more economical for a operator to comply with the Act's requirements than it is to pay the penalties assessed and continue to operate while not in compliance.

In overseeing the enforcement of the Coal Act the Committee has found that civil penalty assessments are generally too low, and when combined with the difficulties being encountered in collection of assessed penalties (to be discussed, infra), the effect of the current enforcement is to eliminate to a considerable extent, the inducement to comply with the Act or the standards, which was the intention of the civil penalty system.

Investigation of the Scotia mine disaster in Eastern Kentucky provides but one case in point. On March 8 and 11, 1976, two explosions of methane gas in the Scotia mine resulted in the deaths of twenty-three (23) miners and three (3) federal mine inspectors. Methane is a colorless, odorless, tasteless gas which is liberated or escapes naturally in certain mines. (Although methane liberation is most commonly associated with coal mining, it is present in connection with the mining of other minerals also, trona, for example.) Methane is explosive when it constitutes between 5 percent and 15 percent of the atmosphere of a mine, and when, while in that concentration range, it is ignited by some ignition source. The pressure of methane in a mine is controlled by adequate ventilation; and thus, ventilation of a mine is important not only to provide fresh air to miners, and to control dust accumulation, but also to sweep away liberated methane before it can reach the range where the gas could become explosive. In terms then of the safety of miners, the requirement that a mine be adequately ventilated becomes one of the more important safety standards under the Coal Act.

After the Scotia explosions, the Subcommittee on Labor investigated the history of the enforcement of the Coal Act at the Scotia mine, and found a rather disturbing recurrence of citations for violations of the ventilation requirements in the mine. In the period from January 3, 1974 until the date of the first explosion, a total of 62

violations of the ventilation standards were noted. This large number of the same type of violation suggests that the penalty system, as applied at this particular mine, was in sufficient to encourage mine management to comply with the law's requirements. The results of that noncompliance turned out to be tragic. The following table indicates the frequency of violation of the same standard, and the penalties assessed for those violations at the Scotia Mine:

TABLE 3

Date of notice or order	CFR section violated	Type of inspection	Description of violation	Assessed penalty	Collected penalty
Jan. 27, 1975	75.301	Spot safety	Insufficient air reaching last open crosscut separating intake air from return air. 0.8 percent methane detected.	\$450	\$150
Feb. 25, 1976	75.301	...do...	Insufficient air passing through last open crosscut.	135	99
Mar. 3, 1975	75. 301	...do....	Insufficient ventilation in last open crosscut. 10,960 ft.3 of air per minute.	250	130
Mar. 13, 1975	75.301	...do...	Insufficient ventilation of 4,480 ft.3 of air per minute passing through last open crosscut.	115	102
Mar. 19, 1975	75. 301	...do...	Insufficient ventilation in the last open crosscut.	300	135
Apr. 17, 1975	75.301	...do...	Insufficient air passing through last open crosscut.	250	148
Apr. 24, 1975	75.301	Spot healthdo.....	250	148

and
safety.

May 27, 1975	75.301	Spot safety	Insufficient air passing through the last open crosscut. 0.3 percent methane detected.	90	74
-----------------	--------	----------------	---	----	----

That the amount assessed and collected for such violations actually decreased rather than increased raises serious questions in the Committee's mind as to whether MESA was properly following the statutory criteria for the assessment of penalties. The Coal Act provides the criteria by which the amount of a proposed penalty is to be determined, to wit:

the operator's history of previous violations, the appropriateness of such penalty to the size of the business the operator charged, whether the operator was negligent, the effect on the operators ability to continue in business, the gravity of the violation, and the demonstrated good faith of the operator charged in attempting to achieve rapid compliance after notification of a violation (Sec. 109(a)(1) of the Coal Act.)

Analysis of the average assessment per violation throughout the industry for the period January, 1974 to April, 1976 indicates a similar trend to decreasing assessment amounts.

631

43

CHART A

Average assessment per violation processed (all types)
by MESA's Assessment office

From January '74 thru April '76

SOURCE: Mesa's Monthly Activity
Report Assessment Office

[NOTE: CHART IS A GRAPHIC IMAGE NOT INCLUDED HERE]

The Scotia history is not atypical. Similar review of the inspection and penalty assessment and collections at Buffalo Creek showed that prior to the disaster, the operator had been assessed penalties exceeding \$1.5 million, not one cent of which had been paid by the date of the flood. Committee analysis of inspections and assessments at Blacksville prior to the disaster showed a similar trend: 178 of 379 violations at that mine were of the electrical or trolley wire standards, and of \$76,330 assessed, only \$31,090 had been paid.

Section 111(j) of S. 717 reduces the number of criteria upon which the amount of a penalty is to be based from the six in the existing Coal Act to four, to wit: gravity of violation, good faith of the person charged, the history of violations of the operator, and the appropriateness of the penalty to the size of the business involved. It is the intention of the Committee that, by thus reducing the criteria to be judged, the Commission, in assessing penalties, will pay more credence to the criteria remaining. In evaluating the history of the operator's violations in assessing penalties, it is the intent of the Committee that repeated violations of the same standard, particularly within a matter of a few inspections, should result in the substantial increase in the amount of the penalty to be assessed. Seven or eight violations of the same standard within a period of only a few months should result, under the statutory criteria, in an assessment of a penalty several times greater than the penalty assessed for the first such violation.

oT [sic] be effective and to induce compliance, civil penalties, once proposed, must be assessed and collected with reasonable promptness and efficiency. To achieve this objective S. 717 contains a number of significant departures from the present practice under the Coal Act.

632

44

The small amount of penalty collections under the current Coal Act compared to the amount of penalties assessed, is the result of a number of deficiencies which have complicated the administration of the Act by the Department of the Interior and MESA.

A brief discussion of the current procedures by which violations are assessed and penalties collected is warranted. The inspector forwards a copy of the violation notice or order to the MESA assessment office. That office collects a number of such violations into a case, and assesses a penalty. The operator is informed of the amount of the penalty. The operator

may pay the penalty assessed, or is given the opportunity to negotiate a settlement with the assessment officer. When the penalty is not paid, or no compromise is reached, the Office of the Solicitor of the Interior files a Petition for Civil Penalty Assessment with the Office of Hearings and Appeals of the Department, of the Interior, and the case is set for trial before an Administrative Law Judge. The operator can, at any time prior to the final decision of the Administrative Law Judge, negotiate a settlement with the Solicitor. After the Administrative Law Judge enters a decision, a review of that decision may be had by the Board of Mine Operations Appeals of the Interior Department which reviews are commonly de novo examinations of questions of fact. The operator is not obligated to pay the penalty as determined by the final order of the Secretary, and can have a de novo trial of the case in a United States District Court.

This lengthy, and often repetitive procedure encourages delaying the ultimate payment of civil penalties. In addition, the opportunity to compromise assessed penalties are numerous.

Clearly, so long a delay in assessment and collection of civil penalties does not encourage operator compliance with the Act and its standards. The delay in the assessment and collection at Scotia Mine serves as a case study of the deficiencies in administration of the civil penalty program. Table 2, *supra*, shows the delays in assessment and collection of civil penalties for those penalties assessed at Scotia.

In addition to the delay in assessing and collecting penalties, another factor which reduces the effectiveness of the civil penalty as an enforcement tool under the Coal Act is the compromising of the amounts of penalties actually paid. In its investigation of the penalty collection system under the Coal Act, the Committee learned that to a great extent the compromising of assessed penalties does not come under public scrutiny. Negotiations between operators and Conference Officers of MESA are not on the record. Even after a Petition for Civil Penalty Assessment has been filed by the Solicitor with the Office of Hearings and Appeals, settlement efforts between the operator and the Solicitor are not on the record, and a settlement need not be approved by the Administrative Law Judge. Similarly, there is considerable opportunity for off-the-record settlement negotiations with representatives of the Department of Justice while cases are pending in the district courts.

While the reduction of litigation and collection expenses may be a reason for the compromise of assessed penalties, the Committee strongly feels that since the penalty system is not for the purpose of raising revenues for the Government, and is indeed for the purpose of encouraging operator compliance with the Act's

requirements, the need to save litigation and collection expenses should play no role

633

45

in determining settlement amounts. The Committee strongly feels that the purpose of civil penalties, convincing operators to comply with the Act's requirements, is best served when the process by which these penalties are assessed and collected is carried out in public, where miners and their representatives, as well as the Congress and other interested parties, can fully observe the process.

To remedy this situation, Section 111(1) provides that a penalty once proposed and contested before the Commission may not be compromised except with the approval of the Commission. Similarly, under Section 111(1) a penalty assessment which has become the final order of the Commission may not be compromised except with the approval of the Court. By imposing these requirements, the Committee intends to assure that the abuses involved in the unwarranted lowering of penalties as a result of off-the-record negotiations are avoided. It is intended that the Commission and the Courts will assure that the public interest is adequately protected before approval of any reduction in penalties.

The Committee recognizes that settlement of penalties often serves a valid enforcement purpose. The provisions of Section 111(1) only require that such settlements be a matter of public record and approved by the Commission or Court.

An additional difficulty encountered in connection with the civil penalty assessment and collection system under the current Coal Act is the provision of Section 109(a)(4) of that Act. This section provides that when an operator fails to pay a civil penalty within the time prescribed for such payment, the Secretary shall seek enforcement of the penalty in the District Court; and further provides:

[t]he court shall have jurisdiction to enter a judgment enforcing, modifying, and enforcing as so modified, or setting aside in whole or in part the order and decision of the Secretary or it may remand the proceedings to the Secretary for such further action as it may direct. The Court shall consider de novo all relevant issues, except issues of fact which were or could have been litigated in review proceedings before a court of appeals under section

106 of this Act, and upon the request of the respondent, such issues of fact which are in dispute shall be submitted to a jury.

This right to a de novo hearing before a jury in the District Court has had the effect of encouraging operators to require enforcement of civil penalties in the district courts, thus delaying still further the actual payment of the penalties assessed. The resultant backlog of penalty cases has flooded the district courts in the coal mining areas of the country, and the delay engendered has seriously hampered the collection of civil penalties.

S. 717 provides a number of means by which the method of collecting penalties is streamlined. Section 111(j) provides that the civil penalties are to be assessed by the Mine Safety and Health Review Commission rather than by the Secretary as prevails under the Coal Act (Sec. 109(a)(3)). Under the procedures of Sec. 106(a) of S. 777, an operator must, within 15 working days after receipt of notification of civil penalty assessment, notify the Secretary of his intention to contest the assessed penalty. Lack of notification would result in the proposed assessment becoming the final order of the Commission.

634

46

Where a penalty is contested the normal proceedings for the hearing of cases by the Commission controls. A final order of the Commission can be reviewed by the Circuit Court under the provisions of Sec. 107(a), if within 30 days after the entering of the Commission's final order, the operator files a request for review with the Circuit Court. No time frames exist in the current law. In all cases, the Commission's findings of fact are conclusive upon the Court if supported by substantial evidence on the record. Contentions not raised before the Commission cannot be raised for the first time before the Court. The Secretary, under the provisions of Sec. 107(b), may automatically obtain a decree of the court of appeals enforcing the final order of the Commission.

In order to facilitate the collection of civil penalties under this Act, the Secretary has authority both under Section 109(a) and 111(k) to obtain collection of penalties by court decree. In any such action in the District Court, there is no right to de novo review of the Commission's finding of violation and assessment of penalty.

The Committee notes that the administrative assessment of civil penalties without provision for a jury trial at any stage of the proceeding has been upheld as constitutional by the United States Supreme Court in *Atlas Roofing Co. v. Secretary of Labor*, -- U.S. --, 45 U.S.L.W. 4312 (March 23, 1977).

To further facilitate the prompt collection of a final order of assessment, the Act provides for the imposition of interest at an annual rate of eight percent to begin thirty days from the final order of the Secretary, Commission or the Court, as is appropriate. The Committee feels the imposition of interest will further discourage undue delay in payment.

Sec. 113(b) of S. 717 authorizes the Solicitor of Labor to represent the Secretary in all civil litigation except litigation before the United States Supreme Court. The Committee believes that keeping all enforcement responsibilities, including the litigation responsibility, within the same department of the Government, furthers the goal of effective enforcement.

While the bill assigns this litigation responsibility to the Solicitor of Labor, it is the Committee's intent that in carrying out these responsibilities, the Solicitor shall coordinate with the Attorney General in order to resolve situations where two or more agencies of the Federal Government may have varying positions with respect to issues in litigation. Similarly such coordination would be important where the issue is the constitutionality of Federal laws, and it is the Committee's intent that the Solicitor of Labor shall make appropriate arrangements with the Attorney General with respect to the participation of the latter in litigation involving such matters.

Miners entitlements resulting from closure orders

As the Committee has consistently noted, the primary objective of this Act is to assure the maximum safety and health of miners. For this reason, the bill provides at Section 112 that miners who are withdrawn from a mine because of the issuance of a withdrawal order shall receive certain compensation during periods of their withdrawal. This provision, drawn from the Coal Act, is not intended to be punitive, but recognizes that miners should not lose pay because

635

47

of the operator's violations, or because of an imminent danger which was totally outside their control. It is therefore a remedial provision which also furnishes added incentive for the

operator to comply with the law. This provision will also remove any possible inhibition on the inspector in the issuance of closure orders.

Administration

The bill creates a new Assistant Secretary of Labor for Mine Safety and Health, to provide specialized treatment and enforcement of the mine safety and health amendments.

A separate enforcement structure with separate attention to mine safety and health problems is mandated by the very high fatality and injury rates for the industry. At the same time, issues which have arisen in the past, because of overlapping jurisdiction between Interior and Labor, particularly in the area of milling of minerals, will be easier to resolve with the establishment of this new Assistant Secretary.

Because of the increased enforcement and administrative responsibilities under the bill, including increased inspection, enforcement, legal services, and administrative responsibilities, it is anticipated that additional resources may be needed by the Department for personnel and support services. Such resources can be provided through the normal appropriation process as becomes necessary.

The Mine Safety and Health Review Commission

The bill provides a right to contest orders and proposed penalties before the Commission.

The Committee realizes that alternatives to the establishment of a new independent reviewing body exist. For example, under the present Coal Act, review of contested matters is an internal function of the Secretary of the Interior who has established a Board of Mine Operations Appeals to separate his prosecutorial and investigative functions from his adjudicatory functions.

The Committee also recognizes that there are organizational and administrative justifications for avoiding the establishment of new administrative agencies. However, the Committee believes that the considerations favoring a completely independent adjudicatory authority outweigh these arguments.

The Committee believes that an independent Commission is essential to provide administrative adjudication which preserves due process and instills much more confidence in the program.

The Commission is to have five members, who shall be selected from among those who by reason of training, education, or

experience are qualified for consideration. This qualification is not intended to limit the selection of members to technicians. It is the Committee's expectation that nontechnicians with the requisite administrative experience or persons whose qualifications are based upon either formal training or practical experience in mine safety and health or related matters would qualify for appointment. The Chairman and members of the Commission are to be appointed by the President, subject to confirmation by the Senate.

The Commission is authorized to act in panels of three members, with a majority of each panel sufficient to decide a matter. This organization is patterned after that of the National Labor Relations Board

636

48

and is intended to give the Commission a more flexible administrative organization in order to facilitate the efficient processing of cases before the Commission. In this regard, the Committee strongly believes that it is imperative that the Commission strenuously avoid unnecessary delay in acting upon cases.

Procedures

Under the bill, review is sought by notifying the Secretary of an intention to contest an order, notice, or proposed penalty within 15 days after the operator's receipt of the Secretary's order, notice, or proposed penalty. Failure to contest within 15 days, as previously indicated, will result in the Secretary's order, notice, or proposed penalty being deemed a final order of the Commission not subject to review by any court or agency.

The bill provides that initial hearings of the Commission shall be before an Administrative Law Judge. The bill makes provision for transfer to the Commission of the Administrative Law Judges of the Department of the Interior who are experienced in matters of mine safety and health. Hearings before Administrative Law Judges shall be of record. The Commission and its Law Judges are vested with broad authority to compel the attendance of witnesses and testimony and the production of evidence, at any stage of the proceedings, including, but not limited to, prehearing deposition and discovery proceedings, as well as to the hearing itself. Affected miners or their representatives are to be afforded an opportunity to participate in proceedings before the Commission and its Administrative Law Judges. The Committee intends that the Commission shall, insofar as is consistent with provisions of

the Act, develop procedures to facilitate the participation in its proceedings of parties appearing pro se or not represented by counsel.

The decision of an Administrative Law Judge becomes a final decision of the Commission 40 days after its issuance, unless, within such time, the Commission has directed review of the decision. Petitions for review of an Administrative Law Judge's decision must be filed within 30 days after issuance of such decision. Review of Administrative Law Judge decisions is discretionary with the Commission and may be granted on the grounds that a finding or conclusion of the Judge is not supported by substantial evidence, that the Judge's necessary legal conclusion was erroneous, that a Judge's decision is contrary to law or regulations or decisions of the Commission, that a substantial question of law, policy, or discretion exists, or that a prejudicial error of procedure was committed. The bill further provides that the Commission may direct review of a case on its own initiative by vote of two Commissioners, but limited to the grounds that: (1) the decision of the Judge is contrary to law or Commission policy, or (2) involves a novel question. Such limitations on the right of the Commission to direct review on its own initiative shall also apply to issues not raised by a petition for discretionary review. Thus, where review has been granted upon the petition of an aggrieved or adversely affected person, the Commission shall not consider issues which have not been raised in the petition, except on affirmative vote of two Commissioners and on the grounds for review on its own accord contained in section 114(d)(2)(B).

637

49

A decision of the Administrative Law Judge which is not reviewed by the Commission becomes the final order of the Commission and is reviewable or enforceable in the United States Circuit Court for the circuit in which the operator is located or the District of Columbia Circuit.

Decisions of the Commission shall be affirmed if based upon substantial evidence of the record as a whole. See, *Universal Camera Corp. v. NLRB*, 340 U.S. 474 (1950). Since the Secretary of Labor is charged with responsibility for implementing this Act, it is the intention of the Committee, consistent with generally accepted precedent, that the Secretary's interpretations of the law and regulations shall be given weight by both the Commission and the courts.

The Committee believes that the provision of section 114(d) (2)

that matters not raised before an Administrative Law Judge may not be raised before the Commission (except for good cause shown) and the provision of section 107(a) that objections not raised before the Commission cannot be raised before a reviewing court are consistent with sound procedure and do not deny essential due process. The Committee notes that fairness is also protected by provisions which would permit remanding of cases for further factfinding where warranted. It is the Committee's intention that the Commission and Administrative Law Judges permit parties every reasonable opportunity to adequately develop the record within these constraints and consistent with its duty to resolve matters under dispute in an expeditious manner.

New mandatory safety and health training standard

In testimony before the Labor Subcommittee, miners, formerly employed at the Scotia mine, testified that they had not received any safety training prior to being sent underground to work in the mine. These miners testified that they did not even receive rudimentary training in the use of the self-rescuer device which had been provided to them. This despite the provisions of the Coal Act that all miners be instructed in the use of the self-rescuer. (Sec. 317(n)). It was only after those hearings that MESA published proposed regulations providing minimum safety training requirements for coal miners.

The Committee's investigation of the Sunshine and Blacksville disasters disclosed similar situations. At Sunshine, 91 miners died because they were unable to escape poisonous carbon monoxide fumes which were the by-product of a fire in the mine. The miners were untrained in the use of self-rescuers which had been provided by mine management, and had not been adequately trained in the secondary escape routes. The miner who was operating the man-hoist by which miners were being evacuated from the lower levels of the mine finally succumbed to the smoke and fumes, preventing further evacuation of miners, because he did not know how to operate the self-rescuer device which he had with him at the time he died.

At Blacksville, a fire erupted in connection with the moving of a piece of mining equipment. The miners on the scene had not been trained in how to fight fires in the mine and how to react to such a situation. Their confusion in the initial minutes after the fire started resulted in the fire quickly spreading out of control.

The Committee considers the presence of miners in a dangerous mine environment who have not had even rudimentary training in

638

50

self-preservation and safety practices inexcusable; and in the fact that regulations requiring said training have not yet been promulgated is a serious failure in mine safety administration.

In recognition of the fact that health and safety training of miners is essential to achieving the goals of this bill and in recognition of the increasing number of new miners being employed in our expanding mining industry, the Committee has included provisions requiring the Secretary to promulgate safety and health training regulations requiring operators to have approved training programs.

Section 116(b) requires that the training given to miners be given during normal working hours, that miners shall be paid at the normal rate of pay for attending such training, and that if the training is given away from the normal work place, miners are to be compensated for the expenses attendant to taking such training.

Section 116(c) requires that upon the completion of each training program the operator shall certify that the miner received that training, and such certification shall be on a form approved by the Secretary, which shall conspicuously indicate that a false certification of training shall be punishable under section 111 (a) and (g) of the Act. The section further requires the operator to maintain at the mine, available for inspection, a copy of this certification, and the operator shall give a copy of the certificate to each miner upon the completion of training, and when the miner leaves the operator's employ.

It is not the Committee's contemplation that the Secretary be in the business of training miners. This is clearly the responsibility of the operator, as long as such training meets the Act's minimum requirements.

The bill provides a special enforcement sanction in connection with the safety training requirement. Section 105(f) of the bill authorizes an inspector to order removed from a mine any miner found to be at work who has not received the requisite training under the operator's training plan, and to require that such miner not be permitted to return until the appropriate training had been provided. A miner so removed is to continue to receive his compensation until he is finally trained and returned to the mine.

The Committee has noted that construction workers are often faced with safety and health hazards which may be different than those which confront miners. Accordingly, Section 116(d) of the bill requires the Secretary to promulgate safety and health training standards for mine construction workers. It is clearly not the intent of this provision that construction workers be less trained in safety and health matters than other miners. But it is the Committee's belief that it may require different training procedures to adequately inform construction workers of the hazards which they may confront. Further, the Secretary's regulations concerning safety and health training for construction workers may give appropriate consideration to safety and health training which has been given to mine construction workers elsewhere as long as the Secretary is satisfied that such training realistically deals with hazards that such workers are likely to confront in the mines.

The Committee is aware that MESA has prepared mandatory training regulations for coal miners and that final rules are likely to be

639

51

promulgated before the effective date of this Act. To the extent that the Secretary of the Interior's training regulations applicable to coal mines fulfill the requirements of this provision, they should continue in effect. If such standards need amendment to comply with the statutory requirements of this bill, only those deficient areas need be amended.

The Committee recognizes that some States, namely West Virginia and Kentucky, provide pre-employment training to individuals who may apply for jobs as miners. Such training may meet the requirements of the standards promulgated by the Secretary, and, assuming that such training is of sufficient quality, the operator should not be required to duplicate State-provided training.

The Committee believes that the ready availability of mine rescue capability in the event of an accident is a vital protection to miners. Accordingly, Section 116(e) requires that mine rescue teams be available for rescue work at each underground mine, and that operators may make cooperative arrangements to provide for the availability of mine rescue teams.

Respirable Dust

Section 318 of the Federal Coal Mine Health and Safety Act of

1969 is amended by deleting subsection (k) which defines respirable dust in terms of dust particulates 5 microns or less in size. The new definition in subsection (e) defines respirable dust in terms of average concentration, a method of determining the amount of dust in a mine atmosphere on the basis of weight. Since all devices approved by the Secretary and the Secretary of Health, Education and Welfare measure respirable dust on the basis of weight, arther [sic] than particle size, this amendment is necessary to make the definition of respirable dust conform to the approved method of sampling.

TRANSFER MATTERS

General

The bill transfers all duties under the mine safety and health laws to the Department of Labor except as otherwise expressly provided. Under the bill, transfer of duties from the Department of the Interior to the Department of Labor will take place effective July 1, 1978. The Committee intends that upon enactment, both Departments will promptly commence planning for an orderly transition of responsibilities.

Personnel and Resources

Section 301(c) of the bill provides for the transfer to the Department of Labor of unexpended appropriations, personnel, property, records, obligations, and commitments.

The Committee intends that section 301(c) is to be liberally construed in order to assure that the transfer of personnel, resources and funds will be completed. Personnel resources, and funds transferred shall include, but not be limited to attorneys servicing the transferred functions, persons involved with standard-setting, and management and administrative support resources devoted to the transferred functions.

640

52

Personnel who are transferred to the Department of Labor are to be transferred without reduction in classification or compensation for a period of one year after such transfer. The Secretary retains authority to reassign personnel pursuant to section 301(c)(1) of the bill. In connection with such transfers and reassignments, the Committee intends that relocation of personnel and reductions in force should be, to the extent possible, minimized. It is the Committee's intention that the service of the Department of the Interior personnel transferred

to the Department of Labor under this bill will be counted as Agency service within the Department of Labor for purposes of seniority, salary retention, and other benefits under the Civil Service laws, regulations and policies which are dependent upon length of service with an Agency.

It should be noted that transfer of enforcement functions to the Department of Labor will automatically give mine inspectors the protection of section 1114 of title 18 of the United States Code, which section provides protection to certain officers and employees of the United States.

Preservation of Established Rules and Pending Proceedings

In order to further assure a smooth transfer, the bill provides, as is customary, that all orders, decisions, rules, regulations, permits, contracts, certificates, licenses and privileges presently in effect and pertaining to transferred functions shall continue in effect until modified or set aside by authorized officials, the courts, or by operation of law. Likewise, proceedings pertaining to transferred functions, which proceedings are pending at the effective date of transfer shall not be affected, except that such proceedings, to the extent related to transferred functions, shall be continued before the Secretary of Labor, or the Review Commission as if the bill had not been enacted. This provision is also intended to permit appropriate enforcement actions under this Act on the basis of investigations or inspections commenced prior to the effective date of the Act, when such investigations or inspections had not yet resulted in citations, notices, or orders to an operator.

With regard to standards-setting proceedings which had commenced but were not completed prior to the effective date of the Act, the Committee intends that the Secretary of Labor have the necessary flexibility to complete those proceedings expeditiously and without subjecting the new or revised standard to challenge on grounds of technical noncompliance with statutory procedures unrelated to the merits of the standard itself.

Existing mandatory standards under the Coal and the Metal Acts, that present mandatory standards will continue in effect until superseded by the Secretary of Labor. Provision is made for review of "advisory" standards promulgated under the Metal Act and conversion of those standards appropriate into mandatory standards.

Retention of safety research and training by the Department of the Interior

It is the intent of the Committee that the Secretary of the

Interior and the Secretary of Health, Education, and Welfare, respectively,

641

53

continue to be responsible for the safety and health research programs for both the coal and the noncoal segments of the industry in accordance with the assignment of these responsibilities made to each Secretary under section 501 of the Coal Act.

Because training is a logical adjunct of research, the bill provides that "the National Mine Health and Safety Academy" is retained in the Department of the Interior, and is to be utilized by the Secretaries of Labor and HEW in the performance of their statutory and other duties relating to the training of mine health and safety inspectors, mining personnel, and other persons. This assists the Secretaries in performing these functions by placing the Academy where it has most direct access to the mining expertise, facilities and research and development technology that are available in the Interior's Bureau of Mines and Geologic Survey.

However, it should be noted that it is the intention of the Committee that technological support facilities which relate to the enforcement function, such as the statistical and analytical computer centers and laboratories which are used for such matters as testing and certification activities and in connection with inspection responsibilities, are to be transferred to the Department of Labor.

Inspector qualifications

Section 303(e)(2) establishes the qualifications of inspectors, however, the Committee intends that persons who are qualified only by virtue of training or education, particularly in the field of health, should not be automatically excluded.

TABULATION OF VOTES IN COMMITTEE

Pursuant to section 133(b) of the Legislative Reorganization Act of 1946, as amended, the following tabulation of votes in committees is provided.

FULL COMMITTEE

Senator Randolph's motion to report the bill favorably, as amended. (adopted 11-0)

YEAS.--Mr. Williams, Mr. Randolph, Mr. Pell, Mr. Kennedy, Mr. Nelson, Mr. Hathaway, Mr. Riegle, Mr. Javits, Mr. Schweiker, Mr. Stafford, and Mr. Hayawaka.

NAYS.--None.

LABOR SUBCOMMITTEE

Senator Randolph's motion to report the bill favorably was amended to the Committee on Human Resources. (adopted 6-0)

YEAS.--Mr. Williams, Mr. Pell, Mr. Riegle, Mr. Javits, Mr. Schweiker, and Mr. Stafford.

NAYS.--None.

ESTIMATE OF COSTS

In accordance with the requirements of Section 252 of the Legislative Reorganization Act, the Committee provides the following estimate of the costs of this bill.

642

54

No government agency has submitted to the Committee any cost estimate by which a comparison can be made with the Committee estimate of the cost of this legislation.

COST ESTIMATE ON S. 717 SUBMITTED TO THE COMMITTEE ON HUMAN RESOURCES BY THE CONGRESSIONAL BUDGET OFFICE

CONGRESSIONAL BUDGET OFFICE,
U.S. CONGRESS,
Washington, D.C., May 13, 1977.

Hon. HARRISON A. WILLIAMS, Jr.,
Chairman, Committee on Human Resources,
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: Pursuant to Section 403 of the Congressional Budget Act of 1974, the Congressional Budget Office has prepared the attached cost estimate for S. 717, the Federal Mine Safety and Health Amendments Act of 1977.

Should the Committee so desire, we would be pleased to provide further details on the attached cost estimate.

Sincerely,

ALICE M. RIVILIN
Director.

Attachment.

CONGRESSIONAL BUDGET OFFICE--COST ESTIMATE

1. Bill number: S. 717.
2. Bill title: Federal Mine Safety and Health Amendments Act of 1977.
3. Bill purpose: S. 717 repeals the Federal Metal and Nonmetallic Mine Safety Act of 1966 and amends the Federal Coal Mine Health and Safety Act of 1969 to include all mines, coal and other. In addition, S. 717 provides for the following:
 - A. Transfer of functions for the Mine Enforcement and Safety Administration from the Department of the Interior into the Department of Labor;
 - B. Establishment of advisory committees at the discretion of the Secretary of Labor;
 - C. Increased number of mandatory inspections for surface mines; and
 - D. Establishment of a Federal Mine Safety and Health Review Commission.

643

55

4. Cost estimate:

[In millions of dollars]

Fiscal years

	1978	1979	1980	1981	1982
Sec. 103: Advisory Committee.....	0.025	0.105	0.110	0.100	0.100
Sect. 104: Inspections, investigations, and recordkeeping:					
Sec. 104(a).....	2.3	10.0	10.6	11.2	11.9
Sec. 104(a).....	.9	4.1	2.1	2.2	2.3
Sec. 104(c).....	.25	1.1	1.2	1.3	1.4
Sec. 104(h).....	.10	.48	.51	.54	.57
Total.....	3.55	15.68	14.41	15.24	16.17
Sec. 105(d): Citations and orders.....	.10	.48	.51	.54	.57
Sec. 114: Assessment of civil penalties (Federal Mine Safety and Health Review Commission).....	1.4	5.9	5.2	5.	5.8
Sec. 303(a)(3): NIOSH.....	.4	1.7	1.8	1.9	2.0
Sec. 303(a)(3): Authorization: Research.....	6.3	25	25	25	25
Sec. 303(d): Authorization: State grants.....	1.3	5	5	5	5
Total cost.....	13.1	53.9	52	53.3	54.6
Offsetting receipts	-4.0	-14.0	-20	-20.0	-20.0
Total.....	.1	39.9	32	33.3	34.6

5. Basis for estimate: The projected costs associated with Section 103 are based on experience from similar advisory committees currently operating under the Department of Labor. It is assumed that during the first two years, meetings will be held more frequently in order to review and advise on standard setting.

The cost estimate for general inspections, Section 104, assumes mandatory inspections of a complete nature at least four (4) times annually for all underground mines and at least two (2) times a year for all surface mines. Presently, under the Federal Coal Act, this requirement is being met, so that additional costs reflect increased inspection activity only for metal and nonmetallic mines. MESA estimates an additional 9,500 inspections or an increase of 310 positions for a total cost of \$9.3 million (310 positions x \$30,000).

Section 104(a) also requires additional testing in the specific area of potential environmental hazards, thus increasing the weighing and analysis of dust samples. MESA estimates that this new requirement will demand 65 new staff positions and expenditures for necessary analysis equipment for a total cost of \$3.8 million. It is assumed that approximately 50 percent of this amount will be purchase of equipment of a one-time basis, so that in years after 1979 the majority of costs associated with this subsection will be personnel costs.

Section 104(c) requires that additional health data of all workers exposed to toxic substances and harmful physical agents be computerized. The MESA estimate for this section is an additional 20 positions. Along with hardware costs, the total comes to \$1 million.

Lastly, Section 104(h) requires additional spot inspections over and above those presently performed. According to MESA, there are 35 additional mines releasing 500,000 cubic feet of explosive gases during a 24-hour period which would require inspections every 10 days, and 63 additional mines releasing 200,000 cubic feet of explosive gases which must be inspected every 15 days. These new requirements will necessitate the addition of 15 positions, for a total of \$450,000.

644

56

Two additional areas that would increase expenditures if the provisions of the Coal Act were applied to all mines are: (1) Assessment of Civil Penalties and (2) Medical Examinations.

The cost estimate for Section 114 reflects an increase in activity in the area of Assessment of Civil Penalties. Currently, no such provision exists under the Federal Mine and Nonmetallic Mine Safety Act, so the application of this provision as under the Federal Coal Mine Health and Safety Act of 1969 would require additional personnel.

Based upon their experience related to coal violations, MESA calculates that 130 positions would be necessary to process 130,000 violations of non-coal mine activity. Using a per-position cost of \$24,500, an additional \$3.2 million is estimated to be required in the first year.

S. 717 also includes the use of a new formula utilizing four instead of six criteria in assessing violations. This necessitates reprogramming existing equipment and realizing a one-time cost of \$1 million.

In addition, the appeals process, currently conducted by the Department of the Interior's Office of Hearings and Appeals but to be transferred under this bill to the Department of Labor, would require another 75 positions due to the increase in responsibility and workload. Personnel costs for this office are estimated at \$20,000 per position, or total cost of \$1.5 million. It is assumed that start-up and operating costs for the Federal Mine Safety and Health Review, Commission are included in this amount.

Under existing regulations of the Federal Coal Act, NIOSH (National Institute of Occupational Safety and Health) through its research is required to process medical examinations. In MESA's opinion, the workload associated with this requirement will increase three-fold at an estimated additional cost of \$1.6 million.

Finally, under Section 303(a), there is to be authorized an additional \$25 million for research; and under Section 303(d) an additional \$5 million for state grants. In each case, the appropriation level is assumed to equal the authorization level.

Outyear personnel costs are inflated by CBO projections for General Schedule pay increases. Also, the estimate assumes that costs for FY 78 are based upon a quarter-year of activity.

Because of the increased activity in assessment, of civil penalties, MESA estimates that \$20 million will be assessed against metal and nonmetallic mine operators (approximately 130,000 violations at \$150 each). The amount of offsetting receipts into the U.S. Treasury from payments of fines is calculated on the basis of a collection rate of 25 percent the first year, 50 percent the second year, and 30 percent the third year, based on previous experience with coal violations. It is assumed that an additional \$20 million will be assessed in each subsequent year.

Although other provisions of the bill include the creation of

new responsibilities within the Department of Labor, these should not generate additional costs, for they represent a one-to-one transfer from the Department of the Interior.

6. Estimate comparison: Not Applicable.
7. Previous CBO estimate: None.
8. Estimate prepared by: Mary Plaska (225-7766).
9. Estimate approved by: Budget Analysis.

JAMES L. BLUM
Assistant Director for Budget Analysis.

645

57

REGULATORY AND PAPERWORK IMPACT

Pursuant to the requirements of Section 5 of the Rule XXIX of the Standing Rules of the Senate, the Committee makes the following evaluation of the paper work and regulatory impact of S. 717.

Health and safety in the mining industry is currently regulated by two laws, the Metal and Non-metallic Mine Safety Act and the Federal Coal Mine Health and Safety Act of 1969. S. 717 combines that regulation under a single statute. Additional regulatory impact under this bill thus, is limited.

To assist the Senate in understanding the scope of the industry affected the following information (based on 1976 figures) is provided:

Employment

Coal	Men employed
Underground	135,977
Surface	75,894
Total	<u>211,871</u>
Metal and nonmetal mines and mills:	
Underground	40,012

Surface	134,013
Mills	100,515
Total	<u>274,540</u>
Grand total	486,411

Mining Operations

	Number of mines
Coal:	
Underground	2,337
Surface	3,215
Total	<u>5,452</u>

Metal and nonmetal mining operations	Number of year round active mines	Intermittent or seasonal mines
Underground	629	365
Open pit	1,436	350
Crushed stone	3,510	806
Sand and gravel	5,368	2,450
Mills	858	75
Totoal	11,801	4,046
Grand total	21,299	

The Committee estimates the cost of complying with the provisions of this bill, for the entire mining industry, both coal and non-coal, will be approximately \$69.15 million per year. These costs will result from operators' compliance with the provisions of the bill requiring health and safety training of miners, from additional inspections required by the bill, and from salaries of miners who may exercise the right created in the bill to participate in mine inspections. This estimate

also includes the cost of complying with standards which may require warning labels on machinery and chemicals used in mines, additional medical examinations of miners, and monitoring of miner exposure to toxic substances or harmful physical agents.

The Committee believes that improved safety and health in the industry will result in the decrease in "down-time" and improved miner morale and increased production. The net cost to the industry, then, should be reduced by the effect of these improvements. The Committee cannot estimate the industry's potential savings in this respect, but it believes they will significantly reduce the economic impact reflected in the estimate above.

The cost to the industry of complying with new standards which may be promulgated by the Secretary is difficult to estimate. The Committee believes that, in most instances, operators will be able to comply with standards by altering existing mining operations at minimum cost. The Committee also firmly believes that any cost outlay necessary to comply with standards will be made up with increased productivity and reduced compensation in event of death, injury or disability.

The bill contemplates minimal record keeping of a personal and private nature. The bill has provisions to assure the privacy of the individuals. For example, Section 104(f)(1) permits miners to request inspections and requires the Secretary to provide the mine operator with a copy of such requests. In all such cases, the names of the complaining miner and of individual miners named in such complaint are not to appear on the copy presented to the operator.

Section 102(a) (6) authorizes the Secretary to promulgate regulations which may require the periodic medical examinations of miners, either by the Secretary of Health, Education, and Welfare or by the operator. Where medical examinations are conducted by the Secretary of Health, Education and Welfare, the results of those examinations can be available only to the Secretaries, or on the specific permission of the miner involved, to his personal physician. The Committee believes that such information would be protected by the Privacy Act and would not be releasable by the Secretaries. This requirement then should constitute no interference with the privacy of the miners. Where such medical examinations are provided at the operator's expense, examination results could be available to the operator, within the limits of the physicians' ethical considerations. In such cases, every effort to protect miners from discrimination or

adverse action as a result of the release of his medical records is provided. The provisions concerning medical evaluation of miners will require additional paperwork by mine operators or their physicians.

Section 102 permits the Secretary to include in promulgated regulations the requirement that operators monitor and maintain accurate records of miner exposure to toxic substances or other harmful agents. In addition, Section 116 requires operators to maintain accurate records of the safety and health training which is provided to miners. Simple record keeping in connection with this requirement is contemplated.

These records are necessary for enforcement of the training requirement for the development of information regarding causes and prevention of occupational accidents and illnesses, and for identifying

647

59

exposed employees so that appropriate treatment and protective action can be provided. To the extent that accurate records in these areas are maintained, the need for inspection and investigation by the Secretaries of Labor and Health, Education, and Welfare will be reduced.

The Committee believes that required paperwork should be kept to a minimum, and toward that end, Section 104(d) cautions the Secretaries, in imposing paperwork requirements, to do so in a manner which will impose a minimum burden on operators, paying special attention to those operating small businesses. The section further provides that unnecessary duplication of effort in connection with paperwork requirements are to be kept to a minimum.

SECTION-BY-SECTION ANALYSIS

Title I--Amendments to the General Provisions of the Federal Coal Mine Health and Safety Act of 1969

Section 101--This section amends section 1 of the Federal Coal Mine Health and Safety Act of 1969 so that it is now cited as the "Federal Mine Safety and Health Act of 1977."

Section 102--Definitions and applicability.

Section 102(a)(1)--provides that Section 2 of the Federal Mine Safety and Health Act of 1976 is amended by striking out "coal"

wherever it appears.

Section 102(a)(2)--references to the Secretary of the Interior to become references to the Secretary of Labor.

Section 102(b)(1)--changes the definition of "Secretary" in section 3(a) from Secretary of the Interior to Secretary of Labor.

Section 102(b)(2)--clarifies the definition of "operator" to include independent contractors performing services or construction at a mine.

Section 102(b)(3)--enlarges the definition of "mine" in section 3(h) to include those mines previously covered by the Federal Metal and Non-Metallic, Mine Safety Act. This definition is also expended to include facilities for the preparation of coal, except that the Secretary is to give due consideration to the convenience of giving one Assistant Secretary all authority with respect to health and safety of miners employed at one physical establishment.

Section 102(b)(4)--expands the definitions of "operator," "agent," "miner," and "imminent danger" in sections 3(d), (e), (g), and (j), respectively, to apply to all mines now covered by the Act.

Section 102(b)(5)--amends section 3 to add a new section 3(n) defining "Administration" which means the Mining Enforcement and Safety Administration established under section 302 of this Act and a new section 3(o) defining "Commission" which means the Federal Mine Safety and Health Review Commission which is established in the Act.

Section 102(c)--amends section 4, "Mines Subject to Act," to include in addition to coal mines, mines newly covered by this Act.

Section 102(d)(1)--amends section 5(c) to conform the wording thereof to the new definition of "Secretary," but the meaning is unchanged.

648

60

Section 102(d)(2)--includes operators and miners' representatives of mines newly covered by this Act among those that may ask the Interim Compliance Panel for a public hearing under section 5(f), and changes the wording of that section to

conform to the new section number for "Judicial Review."

Title II--Mine Safety and Health Standard Amendments

Amendments to title I

Section 202--This section amends Title I of 1969 so that it includes:

Section 101--Duties.

Section 101(a)--establishes the duty of each mine operator to comply with the health and safety standards, all rules regulations, and orders promulgated under this Act and to furnish a place of employment free from recognized hazards causing or likely to cause death or physical harm.

Section 101(b)--establishes the duty of each miner to comply with the health and safety standards, all rules, regulations, and orders promulgated under this Act which are applicable to his own conduct.

Section 102--Safety and Health Standards.

Section 102(a)--establishes that the Secretary may promulgate, modify or revoke any health or safety standard by rule in accordance with the provisions of section 553 of Title 5 of the United States Code (without regard to any reference therein to sections 556 and 557 of such title) and the following provisions.

Section 102(a)(1)--provides that the Secretary may request the recommendations of an advisory committee appointed under section 103 whenever he determines from information submitted to him in writing or on the basis of his own information that a rule should be promulgated, except that when the recommendation comes from the National Institute for Occupational Safety and Health, the Secretary must within sixty days after receipt thereof either commence rule making or publish in the Federal Register his decision not to do so.

When an advisory committee is appointed, the Secretary must provide such committee with any proposal of his own or of the Secretary of Health, Education, and Welfare as well as any factual information that has been developed. The advisory committee must submit to the Secretary its recommendations within 90 days from the date of its appointment or a longer or shorter period of time prescribed by the Secretary, but no longer than 180 days after the appointment.

Section 102(a)(2)--requires the Secretary to publish a proposed rule in the Federal Register and afford interested persons a period of 30 days after publication to submit written comments. Where an advisory committee is appointed the Secretary must publish the proposed rule within 60 days after submission of the committee's recommendations or the expiration of the period prescribed by the Secretary for those recommendations, if he decides to publish such recommendations and if he decides not to publish such recommendations, he shall publish the reason for his determination not to.

Section 102(a)(3)--permits any interested person to file with the Secretary written objections to the proposed rule and request a public hearing before the expiration of the comment period provided for in

649

61

section 102(a)(2), within 60 days after the last day for filing such objections, the Secretary shall publish in the Federal Register a notice specifying the standard objected to and the time and place for a hearing.

Any such hearing shall be held promptly and shall be conducted in accordance with procedural rules or rulings which the Secretary shall make in order to avoid unnecessary costs or delay. The Secretary is authorized to subpoena witnesses and evidence necessary to adequately develop the record. A verbatim transcript of all such hearings shall be made, and available to the public.

Section 102(a)(4)--provides that within 90 days after expiration of the comment period under section 102(a)(2) or after certification of the record of a hearing under section 102(a)(3), the secretary shall issue a rule or determine that a rule shall not be issued. In order to insure that affected employers and their employees are informed of the existence of the standard and its requirements, an issued rule may contain a provision delaying its effective date for a period determined by the Secretary.

Section 102(a)(5)(A)--requires the Secretary, in promulgating standards, to set the standard which most adequately assures on the basis of the best available evidence that miners will not suffer, impairment of health or functional capacity, even if regularly exposed to the hazards throughout their working lives. Development of standards is to be based on research, demonstration, experiment, and other appropriate information. In

addition to the attainment of the highest degree of safety and health protection for the miner, other considerations shall be the latest available scientific data in the field, the feasibility of the standards and experience gained under this and other health and safety statutes. Wherever practicable, the standard should be expressed in terms of objective criteria and performance desired.

Section 109(a)(5)(B)--requires the Secretary of Health, Education and Welfare to identify toxic materials or harmful physical agents found in mines and to within eighteen months of enactment of these Amendments, and on a continuing basis there-after, determine whether those substances or agents pose a threat to miners in the concentrations in which they are normally found in a mine. Thereafter appropriate criteria, are to be transmitted to the Secretary as developed who shall within sixty days after receipt thereof, for all agents or substances not already covered by an appropriate standard, either commence formal standard promulgation procedures under Section 102(a)(1) or 102(a)(2), or shall publish his determination not to do so.

Section 102(a)(6)--provides that any standard promulgated under section 102(a) must prescribe the use of labels or other warnings necessary to ensure that miners are apprised of all hazards to which they are exposed, relevant symptoms and appropriate emergency treatment and proper conditions and precautions of safe use or exposure. A standard, when appropriate, shall prescribe protective equipment, control or technological procedures to be used, and shall provide for monitoring or measuring miners' exposure as may be necessary for the protection of the miners. Where appropriate, such standard shall prescribe the type and frequency of medical examination

650

62

or tests which the operator shall provide, at his cost; in order to determine whether the miner exposed to such hazards is adversely affected by such exposure. Such standards shall provide that where a determination is made that a miner may suffer material impairment of health or functional capacity as a result of exposure to it hazard covered by the standard, miners shall be removed from such exposure and reassigned. Any miner transferred due to such exposure shall receive compensation at not less than the rate for miners in the classification he held immediately prior to his transfer.

The medical examination may be furnished at the expense of the Secretary of Health, Education, and Welfare if he determines them

to be in the nature of research. The results of such examination or tests shall be furnished only to the Secretary, the Secretary of Health, Education, and Welfare, and at the miner's request, to his designated physician.

Section 102(a)(7) requires the Secretary, to the extent possible, to promulgate mandatory health and safety standards applicable to mine construction activity which takes place on the surface in a separate part of the Code of Federal Regulation.

Section 102(a)(8)--requires that in promulgating or revoking standards or in publishing any rule under Title I the Secretary shall not reduce the protection afforded miners below that of any standard previously in effect.

Section 102(b)(1)--provides that where the Secretary determines that miners are exposed to grave danger from exposure to substances or agents determined to be toxic or physically harmful and that an emergency temporary standard is necessary to protect the miners, he may promulgate an emergency standard effective upon publication in the Federal Register without regard to the rulemaking procedures of the Administrative Procedure Act.

Section 102(b)(2)--provides that an emergency temporary standard shall be effective until superseded by a standard promulgated in accordance with the procedures prescribed in section 102(b)(3).

Section 102(b)(3)--requires the Secretary to begin a proceeding for promulgating a standard in accordance with section 102(a) upon publication of the emergency temporary standard. The emergency temporary standard shall serve as the proposed rule in such a proceeding and the Secretary shall promulgate the permanent standard no later than nine months after publication of the emergency temporary standard.

Section 102(c)--authorizes the Secretary to grant a variance if he determines or the Secretary of Health, Education, and Welfare certifies that such a variance is necessary for the operator to participate in an experiment approved by one of the Secretaries designed to improve techniques of safeguarding the health or safety of the workers. Variances under this subsection shall not be granted until the Secretary determines that such a variance will not adversely affect the health and safety of the miners and such miners are notified directly and by publication in the Federal Register.

Section 102(d)--allows operators or miners' representatives to apply to the Secretary for a variance from a standard. Affected miners and their representative must be given notice of each such

application

651

63

and an opportunity to participate in a hearing. The Secretary shall issue a variance if he determines on the record, after opportunity for an inspection where appropriate and a public hearing that the operator will provide conditions as safe and healthful as those which would prevail if he complied with the standard. The order of variance shall prescribe the conditions the operator must maintain and the practices he must use to the extent they differ from the standard. Such an order may be modified or revoked upon application by an operator, miners, miners' representative, or by the Secretary in the manner prescribed for its issuance.

Section 102(e) provides that subsection (d) shall not apply with respect to any coal health standard in effect on the effective date of the Federal Mine Safety and Health Amendments Act of 1977.

Section 102(f) allows persons adversely affected by a standard to challenge its validity within 60 days of its promulgation. In the appropriate U.S. court of appeals. Unless ordered by the court, such challenge shall not operate as a stay of the standard.

Only objections which are raised during the administrative proceedings shall be considered by the court in reviewing such standards, unless failure to have raised such objections earlier shall be excused by the court due to extraordinary circumstances. The procedures of this Section shall be the exclusive means of challenging the validity of the standards.

Section 103--Advisory Committees.

Section 103(a)--allows the Secretary to appoint advisory committees to assist him in his standard setting functions under section 102(a) and advise him on other health and safety matters. Each committee may include one or more designees of the Secretary of Health, Education, and Welfare, the National Bureau of Standards, and the National Science Foundation, operator and miner representatives in equal numbers, one or more representatives of State mine inspection or safety agencies. It may include other members qualified by knowledge and experience who shall not exceed in number the members from Federal and State agencies. Committee meetings must be open to the public and the record thereof be made available to the public. No committee

member, except representatives of the operator and miners, shall have an economic interest in any proposed rule.

Section 103(b)--provides for the compensation for committee members from private life according to the provisions for section 3109 of title 5, United States Code for consultants or experts. The Secretary shall pay to the States the actual costs to them of their representatives' membership on the Committee.

Section 104--Inspections, investigators, and recordkeeping.

Section 104(a)--authorizes the Secretary or the Secretary of Health, Education, and Welfare, or the authorized representative of either, to make frequent inspections of mines to (1) obtain, utilize and disseminate information relating to the health or safety of miners, the causes of accidents, and of diseases or impairments originating in such mines, (2) gather information with respect to standards, (3) determine whether an imminent danger exists, and (4) determine whether there is compliance with the Act and its requirements. The Secretary is required to make inspections of all underground mines

652

64

their entirety at least four times per year, and of all surface mines in their entirety at least two times per year, and the Secretary is authorized to establish guidelines for such additional inspections of mines where warranted. No advance notice of inspections is to be given.

Section 104(b)--allows the Secretary to require the attendance and testimony of witnesses and the production of evidence under oath in connection with investigations of accidents and other occurrences. Witnesses will be paid the same as witnesses in U.S. courts. The appropriate district courts, upon application by the Secretary shall have jurisdiction over witnesses failing to appear and may issue orders requiring such appearance. Failure to obey such an order may be punished as contempt.

Section 104(c)(1)--requires each operator to maintain and make available to the Secretaries such records that the Secretary, in cooperation with the Secretary of Health, Education, and Welfare, prescribes as appropriate for the enforcement of the Act or for developing information regarding the causes and prevention of occupational accidents and illnesses in the mines. Regulations issued pursuant to this paragraph may include provisions requiring operators to conduct periodic inspections.

Section 104(c)(2)--provides that the Secretary, in cooperation with the Secretary of Health, Education, and Welfare, shall require operators to maintain records of and make periodic reports on work-related deaths, injuries, and illness except for minor injuries requiring only first aid treatment.

Section 104(c)(3)--requires the Secretary, in cooperation with the Secretary of Health, Education, and Welfare, to issue regulations requiring operators to maintain records of miner exposures to potentially toxic or harmful physical agents that must be monitored or measured under the Act's health and safety standards. The regulations are to give miners or their representatives an opportunity to observe the monitoring or measuring and to give miners and former miners access to such records of individual exposure. Operators are to notify miners of overexposure and shall inform over-exposed miners of the corrective action being taken.

Section 104(c)(4)--provides that all accidents except some unintentional roof fails, shall be investigated by the operator or his agent to determine the cause and means of preventing recurrence. Records of accidents and investigations shall be maintained and made available to the Secretary and the appropriate State agency. Such records shall be open for inspection by interested persons.

Section 104(d)--requires that information obtained under the Act must be obtained with a minimum burden upon operators, especially those operating small businesses. Unnecessary duplication of efforts in obtaining information is to be reduced as much as possible.

Section 104(e)--provides that subject to regulations issued by the Secretary a representative of the operators and a representative of the miners shall be given an opportunity to accompany the inspecting official during the inspection of a mine under section 104(a) and to participate in any pre- and post-inspection conferences at the mine site. Where there is no authorized miner representative the inspector shall consult with a reasonable number of miners. If he determines more than one representative from each party would aid the inspection,

653

65

the inspector may permit each party an equal number of additional representatives. A miner representative who is also employed by the operator shall not lose pay for his participation in the

inspection, but only one such miner shall be authorized to be paid pursuant to this subsection. Compliance with this subsection shall not be a jurisdictional prerequisite to the enforcement of any provision of this act.

Section 104(f)(1)--provides that if any miner or his representative believes that a standard violation exists that threatens physical harm or that an imminent danger exists, he may request an inspection by giving written notice with his signature to the Secretary or his authorized representative of such violation or danger. A copy of such notice shall be provided to the employer or his agent no later than at the time of inspection but the name of the person giving such notice and the names of the miners referred to therein shall be deleted.

If the Secretary determines there are reasonable grounds to believe that a violation or danger exists, he shall make a special inspection as soon as practicable. If the Secretary determines that no violation or danger exists, he shall so notify in writing the miners or their representative.

Section 104(f)(2)--provides that prior to or during any inspection any miners or their representatives may notify the federal inspector, in writing, of any violation of this Act or of any imminent danger they believe exists. The Secretary shall, by regulation, establish informal review procedures for any refusal by an inspector to issue a citation with respect to such alleged violation or order with respect to such danger and shall furnish the miners or their representative requesting such review a written statement of the reasons for his final disposition of the case.

Section 104(g)(1)--authorizes the Secretary and the Secretary of Health, Education, and Welfare to publish information obtained under this section.

Section 104(g)(2)--provides that the Secretary and the Secretary of Health, Education, and Welfare shall each prescribe regulations necessary to carry out their responsibilities under this Act.

Section 104(h)--requires the Secretary to provide a minimum of one spot inspection of all or part of a mine during every 5 working days at irregular intervals, if the mine contains some especially hazardous conditions and provides specifically for inspection once each five days of mines liberating 1,000,000 cubic feet of explosive gases each day; once each ten days of mines liberating 500,000 cubic feet of such gases; and once each 15 days of mines liberating 200,000 cubic feet of such gases.

Section 104(i)--provides that if there is a mine accident, the operator shall notify the Secretary and preserve any evidence that would aid an investigation of the cause. The Secretary may supervise rescue and recovery activity in such mine, if such activity is necessary, and take other appropriate action to preserve life.

Secretary 104(j)--provides that if there is a mine accident, and the Secretary's representative is present, he may issue appropriate orders to insure the safety of persons in the mine, and the operator must obtain his approval, in consultation with appropriate State representatives,

654

66

when feasible, of any recovery plan or of any plan to return affected areas to normal operation.

Section 105--Citations and Orders.

Section 105(a)--provides that if, upon inspection or investigation, the Secretary or his representative believes an operator has violated this Act or any standard, rule, order or regulation promulgated pursuant to this Act, he shall with reasonable promptness issue a citation to the operator. The citation shall be written, describe with particularity the nature of the violation, and fix a reasonable time for the violation's abatement.

Section 105(b)--provides that, if upon any follow-up inspection the Secretary's representative finds (1) the cited violations have not been totally abated within the original or subsequently extended abatement period, and (2) the abatement period should not be further extended, he shall find the area affected by the violation and promptly issue an order requiring the operator to withdraw from the affected area all persons (until the Secretary's representative determines the violation has been abated), except the following:

- (1) Any person whose presence is necessary to eliminate the danger, in the judgment of the operator or the Secretary's representative;
- (2) Any public official whose official duties require his presence, or
- (3) Any legal or technical consultant or representative, qualified to make mine examinations or accompanied by such a

person, and whose presence is necessary for the proper investigation of the conditions described in the order, in the judgment of the operator or the Secretary's representative.

Section 105(c)(1)--provides that, if the inspector finds a violation of a standard which could significantly contribute to the cause and effect of a mine health or safety hazard and which was caused by an unwarranted failure of the operator to comply with such standard, he shall issue a citation to the operator, noting such. If within the same or any subsequent inspection within 90 days, the inspector notes another unwarranted failure violation, the inspector shall issue an order, closing the mine or the affected portion of the mine to all individuals except those designated in Subsection (b) until such violation shall be abated.

Section 105(c)(2)--provides that once a withdrawal order has been issued under Subsection (c)(1), another withdrawal order shall be issued if on any subsequent inspection, an unwarranted failure violation is cited. Any such order can be lifted when the underlying violation has been abated; but the provisions of Subsection (c)(1) shall only become applicable to an operator when an inspection of the mine in its entirety indicates no unwarranted failures.

Section 105(d)(1)--provides that if an operator has developed a pattern of violations within a mine which are of a nature which could significantly and substantially contribute to the cause and effect of a mine health or safety hazard, the Secretary shall notify the operator of the existence of such a pattern. If upon an inspection within 90 days after the issuance of such notice, the Secretary or his authorized representative finds any violation of a standard which could significantly and substantially contribute to the cause and effect of a mine safety and health hazard, the inspector shall issue an order requiring all individuals except those designated in Subsection (b) to be withdrawn

655

67

from the mine or the affected area. Such an order will be lifted when the underlying violation has been abated.

Section 105(d)(2)--provides that if a withdrawal order has been issued under Subsection (d)(1) and on any subsequent inspection the Secretary or his authorized representative finds another violation of a standard which could significantly and substantially contribute to the cause and effect of a mine safety

or health hazard, he shall issue an order withdrawing all individuals except those designated in Subsection (b) from the mine or affected area. Such order shall remain in effect until the underlying violation has been abated.

Section 105(d)(3)--provides that an inspection of the mine in its entirety which discloses no violations which could significantly and substantially contribute to the cause and effect of a mine safety or health hazard will terminate the pattern of violations which resulted in the issuance of the notice under Subsection (d)(1). Subsequent such violations can reestablish the pattern, and make the provisions of Subsections (d)(1) and (2) applicable at that time.

Section 105(d)(4)--authorizes the Secretary to make such rules as he deems necessary to establish the criteria for determining the existence of a pattern of violations which could significantly and substantially contribute to the cause and effect of a mine safety or health hazard.

Section 105(e)--requires that during the abatement period for a violation of the respiratory dust concentration limit, the operation must take samples described in section 202(a) during each production shift. The section also provides that, after a withdrawal order has been issued for failure to abate a violation of the respirable dust concentration limit, the Secretary, upon request of the operator, shall provide technical assistance to aid in reducing such dust concentrations. Those persons sent by the Secretary may require the operator to take actions they deem appropriate to insure the health of persons in the mine:

Section 105(f)(1)--provides that if the Secretary's representative, while on an inspection, finds a miner employed in a mine who has not received requisite safety training in accordance with a safety training plan approved by the Secretary in accordance with the provisions of section 116 of the Federal Mine Safety and Health Act of 1977, such a miner is to be declared a hazard to himself and others, and such miner is required to be immediately withdrawn from the mine until the Secretary can determine that such miner has received the requisite training.

Section 105(f)(2)--provides that miners ordered withdrawn from a mine as a result of not having received such training shall not be discriminated against for such reason, and shall suffer no loss of pay during the period until the Secretary finds that such training has been given to the miner.

Section 105(g)--requires that each citation or order or copy thereof issued under this section must be posted in accordance

with section 110 and as prescribed by the Secretary's regulations.

Section 105(h)--provides that any order issued under section 105(b), (c) or (d) is effective until revoked by the Secretary or modified or vacated by the Commission or the courts pursuant to sections 106 or 107.

Section 106. Procedures for Enforcement.

656

68

Section 106(a)--requires the Secretary to notify within a reasonable time an operator issued a citation or order under section 105(a)(1) of any penalty to be assessed under section 111(a) and that the operator has 15 working days to notify the Secretary that he wishes to contest the citation or proposed penalty. A copy shall be furnished the miners' representative.

If the operator fails to notify the Secretary within the 15 working days that he intends to contest the citation or proposed penalty or penalties and if no notice is filed by any miner or miner representative within such time, the citation and penalty or penalties as proposed shall be deemed a final order of the Commission and not subject to review by any court or agency.

Section 106(b)(1)--provides that, if the Secretary believes an employer has failed to correct a cited violation within the abatement period the Secretary shall notify the operator and the miners' representative of such failure, of the proposed penalty under section 111 of that failure, and that the operator has 15 working days to contest the notification or proposed penalty. If the operator does not so notify the Secretary within the 15 working days, the notification and proposed assessment shall be deemed a final order of the Commission and not subject to review by any court or agency.

Section 106(b)(2)--provides that the Mine Safety and Health Review Commission may grant temporary relief from any order issued under Section 105(b) under conditions which it may prescribe if a hearing has been held in which all parties were afforded an opportunity to be heard, the applicant shows substantial likelihood that he will finally prevail on the merits, and such relief will not adversely affect the health or safety of miners. The Commission shall provide procedures for expedited consideration of such cases.

Section 106(c)(1)--prohibits discharging, discriminating

against, or interfering with the exercise of statutory rights by any miner, representative of miners or applicant for employment because such individual filed a complaint or instituted or caused to be instituted any proceeding under or related to this Act, or because such miner is the subject of medical evaluations and potential transfer pursuant to a standard issued under Section 102(a) of this Act, or testified or is about to testify in any such proceeding, or exercised for himself or others any statutory right afforded by this Act.

Section 106(c)(2)--authorizes any miner, representative or miners or applicant who believes that he has been discharged or otherwise discriminated against or interfered with by any person in violation of this subsection to within 60 days after such violation, file a complaint with the Secretary, who shall, within 15 days, commence appropriate investigation. If the Secretary determines that such complaint is not frivolous he shall apply to the Commission for temporary reinstatement of miner pending final outcome of the complaint. If upon such investigation, the Secretary determines there has been such violation, he shall immediately file a complaint with the Commission proposing an order granting appropriate relief. The Commission shall afford an opportunity for a hearing and, based on findings of fact, issue an order affirming, modifying, or vacating the Secretary's proposed order or directing other appropriate relief. Such

657

69

order is final 30 days after its issuance. The Commission shall have the authority to order all appropriate relief, including rehiring or reinstatement of the miner to his former position with back pay and interest, and during any hearing, the miner, miners' representative or applicant may present evidence on his behalf.

Section 106(c)(3)--requires the Secretary, within 90 days of the receipt of a complaint filed under this subsection, to notify the complainant of his determination whether a violation has occurred. If the Secretary determines there is no violation the complainant may file, within 30 days of such notice, before the Commission charging discrimination under paragraph (1). The Commission shall afford an opportunity for a hearing and thereafter shall issue an order dismissing or sustaining the complainant's charges and, if sustained, granting appropriate relief. Such an order becomes final 30 days after its issuance. When such order sustains the miner's charges, all reasonable expenses (as determined by the Commission) incurred by the miner related to such proceedings shall be assessed against the

violator. Proceedings under this section shall be expedited by the Secretary and the Commission. A Commission order under this sub-section shall be subject to judicial review under section 107. Violations of paragraph (1) by any person shall be subject to the provisions of sections 109 and 111(a).

Section 106(d)--provides that if an operator notifies the Secretary that he intends to contest the issuance or modification of an order or a notification, or the reasonableness of an abatement period, or any miner or representative of miners notifies the Secretary that he plans to so contest, the Secretary shall immediately so advise the commission. The Commission must then provide an opportunity for a hearing and thereafter issue an order affirming, modifying, or vacating the Secretary's citation, order, or proposed penalty or directing other appropriate relief. Such an order becomes final 30 days after its issuance.

The rules of procedure prescribed by the Commission shall provide affected miners or their representatives an opportunity to participate as parties to Commission hearings under this subsection. The Commission shall take whatever action is necessary to expedite proceedings for hearing appeals of order issued under section 105.

Section 107. Judicial Review.

Section 107(a)(1)--permits any person adversely affected or aggrieved by an order of the Commission issued under this Act to obtain review of such order or decision in any appropriate U.S. Court of Appeals by filing a written petition within 30 days of the issuance of the order. The subsection specifies those procedures to be followed after a petition for review is filed, including:

(1) The clerk of the courts transmits a copy of the petition to the Commission and other parties.

(2) The Commission file in court the proceeding record pursuant to 28 United States Code 2112 and the courts shall then have exclusive jurisdiction.

(3) The court is authorized to enter and enforce a decree affirming, modifying, or setting aside in whole or in part, the Commission's order.

658

70

(4) Objections not urged before the Commission will not be

considered by the court unless the failure to urge such objection is excused because of extraordinary circumstances. The Commission's findings of fact shall be conclusive when supported by substantial evidence on the record as a whole.

(5) Any party may apply for leave to adduce additional evidence and if such evidence is material and there were reasonable grounds for not adducing such evidence before the Commission, the court may order the evidence taken before the Commission and made part of the record. The Commission may then modify its findings of fact or make new findings and shall file such findings, which shall be conclusive if supported by substantial evidence on the record as a whole. The Commission may modify or set aside its original order due to such modified or new findings of fact.

(6) The judgment and decree of the court shall be final except subject to review by the Supreme Court of the United States, pursuant to 28 United States Code 1254.

(7) Petitions filed under this subsection shall be heard expeditiously.

Section 107(a)(2)--authorizes the court to grant temporary relief or restraining orders, as appropriate, under conditions which it may prescribe, if a hearing has been held at which all parties were given the opportunity to be heard, the applicant for such relief shows that there is a likelihood that the final findings will be favorable to the applicant, and such temporary or other relief will not adversely affect the health or safety of miners.

Section 107(b)--permits the Secretary to petition an appropriate United States Court of Appeals for review or enforcement of the Commission's final order and, to the extent applicable, the provisions of section 107(a) shall govern such proceedings. If no review petition, pursuant to section 107(a) is filed within 30 days after service of the Commission's order, the Commission's findings of fact and order shall be conclusive in connection with any enforcement petition filed by the Secretary after such 30 day period. In any such case, or in the case of a final order by the Commission under section 106(a) or (b), the clerk of the court, unless otherwise ordered by the court, shall enter a decree, enforcing the order and shall transmit copies to the Secretary and operator. In any contempt proceeding to enforce a court of appeal's decree pursuant to section 107(a) and (b), the court of appeals may assess penalties provided in section 111 and invoke other available remedies.

Section 108. Procedures to Counteract Dangerous Conditions.

Section 108(a)--provides that, if upon any inspection or investigation, the Secretary's representative finds an imminent danger exists, he shall determine the affected area and issue a withdrawal order barring all persons except those referred to in section 105(b) from such area. The issuance of an order under this subsection shall not preclude the issuance of a citation under section 105 or the proposing of a penalty under section 111.

Section 108(b)(1)--provides that, if upon any inspection, the Secretary's representative finds (A) conditions exist which have not resulted in an imminent danger, (B) such conditions cannot be

659

71

effectively abated with existing technology, and (C) reasonable assurance cannot be provided that continued mining will not result in an imminent danger, he shall determine the affected area and issue a notice to the operator or his agent of such conditions, and file a copy with the Secretary's and miners' representative. Upon receipt of such copy, the Secretary shall make appropriate investigations, including an opportunity for the operator or miners' representative to present information relating to such notice.

Section 108(b)(2)--provides that upon conclusion of such investigation and an opportunity for a public hearing (when requested by an interested party), the Secretary shall make findings of fact and, by decision, either cancel the notice or issue a withdrawal order barring all persons from the affected area except those referred to in section 105(b) until the Secretary, after a public hearing affording all interested persons an opportunity to present their views, determines that such conditions have been abated. Hearings under this paragraph shall be of record and subject to 5 United States Code 554 but without regard to subsection (a)(3) thereof.

Section 108(c) requires findings and orders issued under section 108(a) to contain a detailed description of the conditions which constitute an imminent danger, and all orders issued under this section to contain a description of the area of the mine through-out which persons must be withdrawn.

Section 108(d)--requires that each finding made and order issued under this section be in writing, signed by the person making them, and given promptly to the affected operator. Any order issued pursuant to sections 108(a) or (b) may be modified

or terminated by the Secretary's representative. Any order issued under sections 108(a) or (b) shall remain in effect until modified or terminated by the Secretary or modified or vacated by the Commission or the courts pursuant to sections 107(a) or 108(e).

Section 108(e) (1)--provides that any operator notified of an order under this section or any miner representative notified of the issuance, modification, or termination of such an order, may apply to the Commission within ten days for its reinstatement, modification or vacation. The Commission shall afford an opportunity for a hearing (in accordance with 5 United States Code 554, but without regard to subsection (a) (3) of such section) and thereafter issue an order, based on findings of fact, vacating, affirming, modifying, or terminating the Secretary's order. The Commission may not grant temporary relief from the issuance of any order under subsection 108(a).

Section 108(e) (2)--provides that the Commission shall take appropriate action to expedite proceedings under this subsection.

Section 109. Injunctions.

Section 109(a) (1)--authorizes the Secretary to institute civil action for relief, including a permanent or temporary injunction or any appropriate order, in any appropriate United States district court whenever an operator or his agent (a) violates or does not comply with any order or decision issued under this Act (b) hinders the Secretary or the Secretary of Health, Education, and Welfare, or their representatives in carrying out the provisions of the Act, (c) refuses to admit such representatives to the mine, (d) refuses to permit

660

72

the inspection of the mine, or the investigation of an accident or occupational disease related to such mine, (e) refuses to furnish any information or report requested by the Secretary or the Secretary of Health, Education, and Welfare in furtherance of the Act's provisions, or (f) refuses to permit access to and copying of such records as the Secretary of Health, Education, and Welfare determine necessary in carrying out provisions of the Act.

Section 109(a) (2)--authorizes the Secretary to institute civil action for appropriate relief, including injunction or restraining order where he determines that an operator is engaged

in a pattern or practice violation of the standards of the Act, or in a similar course of violative conduct which constitutes a continuing hazard to the health and safety of miners.

Section 109(b)--provides that each such court shall have jurisdiction to provide appropriate relief, to include, in cases under subsection (a)(2), requiring assurance or affirmative steps by an operator to assure the court that miners shall be afforded the protection of the Act. Temporary restraining orders must be issued in accordance with rule 65 of the Federal Rules of Civil Procedure as amended, but seven days from the date of entry shall be the time limit when issued without notice. Except as otherwise provided, relief granted by the court to enforce an order under clause (a)(1) of this section is effective until completion of all review proceedings for the order under this title, unless prior thereto, the district court granting such relief sets it aside or modifies it. In any action instituted under this section to enforce an order or decision by the Commission or the Secretary after a public hearing in accordance with 5 United States Code 554, the Commission's or Secretary's findings, if supported by substantial evidence on the record as a whole, shall be conclusive.

Section 110. Postings of Notices, Orders, and Decisions.

Section 110(a)--requires that at each mine there be a mine office and a bulletin board at such office or at or near a conspicuous place near the mine entrance so that notices, orders, citations, or decisions required to be posted thereon and easily see, and protected against damage by the weather and unauthorized removal. A copy of any notice, order, citation, or decision required to be given to the operator must be delivered to the mine office and immediately posted on the bulletin board, for not less than 30 days.

Section 110(b)--requires the Secretary to mail a copy of any notice, order, citation or decision given to an operator to the affected miners' representative and to the State official or agency that administers State laws relating to health or safety in the affected mine. Such notice, order, citation, or decision shall be available for public inspection.

Section 110(c)--provides that in order to insure prompt compliance, the Secretary's representative may deliver any notice, order, citation, or decision to the operator's agent who shall immediately take appropriate measures to comply.

Section 110(d)--requires the name and address of each mine and each person who controls or operates such mine to be filled with the Secretary. Each operator must designate an official

responsible for health and safety at the mine and that official shall receive copies of any notice order, citation, or decision affecting that mine. The designation

661

73

of a health and safety official does not make him subject to any penalty under this Act.

Section 111. Penalties.

Section 111(a)--provides that a civil penalty of up to \$10,000 shall be assessed for each violation of this Act or of any standard, rule, order, or regulation promulgated pursuant to this Act.

Section 111(b)--provides that an operator who fails to correct a violation cited under section 105(a) within the abatement period may be assessed a maximum civil penalty of \$1,000 for each day the violation continues.

Section 111(c)--provides that, whenever an operator violates any standard, rule, order, or regulation promulgated pursuant to this Act, or provision of this Act, any director, officer, or agent of such corporation who knowingly authorized, ordered, or carried out such violation shall be subject to the same civil penalties, fines, and imprisonment that may be imposed upon a person under subsections (a), (b), (d), (e), (f).

Section 111(d)--provides that any operator who willfully violates this Act or any standard, rule, order, or regulation promulgated pursuant to this Act or any standard, rule, order, or regulation promulgated pursuant to this Act shall upon conviction be punished by a fine of not more than \$25,000 or imprisonment of not more than 1 year, or both. For any subsequent convictions, punishment shall be a fine of not more than \$50,000 or imprisonment for not more than 5 years, or both.

Section 111(e)--requires that any person convicted of giving advance notice of any inspection shall be punished by a fine or not more than \$1,000 or imprisonment for not more than 6 months, or both.

Section 111(f)--provides that whoever knowingly makes false statements, representations, or certifications in any document filed or required to be maintained pursuant to his Act shall, upon conviction, be punished by a fine of not more than \$10,000 or by imprisonment for not more than 5 years, or both.

Section 111(g)--provides that any operator who violates any of the posting requirements under the Act shall be assessed a civil penalty of up to \$10,000 for each violation.

Section 111(h)--provides that any miner who willfully violates safety standards related to smoking or the carrying of smoking materials shall be subject to a civil penalty of not more than \$250 for each violation assessed by the Commission.

Section 111(i)--provides that whoever knowingly distributes, sells, offers for sale, introduces, or delivers in commerce any equipment for use in a mine, which is represented as complying with the provisions of this Act, or with any specification or regulation of the Secretary and which does not so comply, shall upon conviction be punished by fine or not more than \$25,000 or by imprisonment for not more than one year, or both.

Section 111(j)--authorizes the Commission to assess all civil penalties and to issue all civil penalty closure orders provided in this Act, giving consideration in assessing civil monetary penalties to (a) the gravity of the violation, (b) the good faith of the person charged, (c) the history of previous violations, and (d) the appropriateness of the

662

74

penalty with respect to the size of business of any operator being charged, provided that, in proposing civil penalties under this Act, the Secretary may rely upon a summary review of the information available to him and shall not be required to make findings of fact concerning the above factors.

Section 111(k)--provides that civil penalties owed under this Act shall be paid to the Secretary for deposit into the U.S. Treasury, and shall accrue to the United States and may be recovered in a civil action brought in the name of the United States in a district court of the United States. Interest at the rate of 8 percent per annum shall accrue on civil penalties unpaid after 30 days of final order of the Secretary, the Commission, or the Court.

Section 111(l)--provides that no proposed penalty which has been contested shall be compromised, mitigated, or settled except with approval of the Commission or the Court, as appropriate.

Section 111(m)--provides that section 111 shall not apply with respect to Title IV of the Federal Mine Safety and Health Act of

1976.

Section 112. Entitlement of Miners.

Section 112--provides that if a mine or an area of a mine is closed by an order issued under section 104, 105, or 108, all miners working during the shift when the order was issued who are idled by such order shall be entitled to full compensation by the operator at their regular rates of pay for the period they are idled, but not more than for the balance of the shift. If the order is not terminated before the next working shift, all miners on that shift shall be entitled to full compensation by the operator at their regular rates of pay for the period they are idled, but not for more than four hours. If the closure results from an order for failure of the operator to comply with a health or safety standard, all miners idled by the order shall be fully compensated by the operator at their regular rates of pay for such time as they remain idled by the closing or for one week, whichever is lesser after all interested parties are given an opportunity for an expedited public hearing and after a final order issues. When an operator fails to comply with an order issued under section 104, 105 or 108, all miners employed at the affected mine who would, by such order, be barred from such mine or area thereof shall be entitled to full compensation at their regular rates of pay, in addition to pay received for work performed after the order was issued, for the period beginning when the order was issued and ending when the order is complied with, vacated, or terminated. The Commission shall have authority to order such compensation under this section when a miner or his representative files a complaint and after an opportunity for a hearing subject to a 5 USC 554.

Section 113. Administrative Provisions.

Section 113(a) authorizes and direct the Secretary to administer this Act through the Mining Enforcement and Safety Administration, Acting through the Assistant Secretary for Mine Safety and Health, the Secretary shall have authority to appoint, subject to civil service laws, such officers and employees as he deems necessary for the administration of this Act, and to prescribe powers, duties, and responsibilities of all officers and employees engaged in administering this act.

663

75

Section 113(b) authorizes the Solicitor of Labor to appear for and represent the Secretary in any civil litigation brought under this Act, except as provided in 28 U.S. Code 518(a) relating to

litigation before the Supreme Court.

Section 114. The Federal Mine Safety and Health Review Commission.

Section 114(a) establishes the Federal Mine Safety and Health Review Commission composed of five members, who shall be appointed by the President with the advice and consent of the Senate from among those who are qualified to carry out the functions of the Commission under this Act. The President shall designate one of the members to serve as Chairman of the Commission.

Section 114(b) provides that the terms of the members of the Commission shall be six years, except that the first appointees to the Commission shall be appointed for terms of 2, 4, and 6 years; and that if the term of one of these three members shall become vacant, the successor shall be appointed for the balance of that term only. This section further provides the reasons for which a member of the Commission may be removed, namely, inefficiency, neglect of duty, or malfeasance in office.

The section gives the Chairman the responsibility for the administrative operations of the Commission, and enables the Commission to appoint employees necessary for the performance of its functions and to fix their compensation under the provisions of 5 U.S. Code Chapter 51 and Chapter 53, subchapter III. Administrative Law Judges currently assigned to mine safety at the Arlington, Va, office of the Department of the Interior Office of Hearings and Appeals are automatically transferred to the Commission on the effective date of the Act, in grade and position and authorizes the Chief Administrative Law Judge to elect to so transfer. The section further provides that Administrative Law Judges associated with mine health and safety assigned to the Western offices of the Office of Hearings and Appeals shall have the option of trans-ferring to the Department of Labor, under the same conditions, or remain with the Department of the Interior. The Commission is further authorized to appoint such Administrative Law Judges as it deems necessary to carry out the functions of the Commission, and the assignment, removal and compensation of the Administrative Law Judges is to be in accordance with 5 U.S. Code, sections 3105, 3344, 5362, and 7521.

Sec. 114(c) provides that the Commission is authorized to delegate to any group of three of its members, any or all of the Commission's powers. Two members shall constitute a quorum of any such designated group.

Section 114(d) (f) --enables an Administrative Law Judge of the

Commission to hear and make determination on any proceeding instituted before the Commission any motion in connection therewith which is assigned to such Administrative Law Judge by the Commission, and requires the Administrative Law Judge to make a report of any such determination which constitutes his final determination. The decision of an Administrative Law Judge shall become the final order of the Commission unless directed to be reviewed within 40

664

76

days in accordance with the rules promulgated under the provisions of section 114(d)(2) of this Act.

Section 114(d)(2) --directs the Commission to prescribe rules of procedures for its review of the Administrative Law Judge's decisions in cases under this Act which shall meet the following standards for review.

(A) Petitions for Discretionary Review (i) Within 30 days of its issuance, any affected or aggrieved person may file a petition for discretionary review by the Commission of an administrative judge's decision. Such review is not a matter of right but of the Commission's sound discretion.

(ii) Such petitions shall be filed only upon one or more to the following grounds:

(1) A finding or conclusion of material fact is not supported by substantial evidence.

(2) A necessary legal conclusion is erroneous.

(3) The decision is contrary to law, or to the Commission's promulgated rules and decisions.

(4) A substantial question of law, policy, or discretion is involved.

(5) A prejudicial error was committed in the proceedings.

(iii) Indicates some technical requirements of such petitions. Also except for good cause shown no assignment of error shall rely on questions of fact or law upon which the administrative law judge has not had opportunity to pass. The Commission's review shall be granted by an affirmative vote of two of the Commissioners present and voting. If granted review shall be limited to questions raised by the petitioner.

(B) Review by the Commission at its own Initiative--Within 30 days after the issuance of a decision of an administrative law judge, the Commission, by affirmative vote of two of the Commissioners present and voting, may review such case but only on the grounds that the decision may be contrary to law or Commission policy or that a novel question of policy has been presented. Such grounds shall be specifically stated in the order to review. If a party's petition for discretionary review has been granted, the Commission shall not raise or consider additional issues in such review proceedings in compliance with this paragraph.

(C) Scope of Review.--For purposes of Commission review under paragraphs (A) and (B) of this subsection, the record shall include (1) all matters constituting the record upon which the decision of the administrative law judge was based, (2) rulings upon proposed findings and conclusions, (3) the decision of the administrative law judge, (4) any petition for discretionary review, responses thereto, and the Commission's order for review, and (5) briefs filed on review. No other material shall be considered by the Commission upon review. The Commission may remand the case to the administrative law judge or affirm, set aside, or modify his decision or order.

Sec. 114(e)--provides that at hearings before the Commission or its Administrative Law Judges, attendance and testimony of witnesses and the production of book and documents may be compelled. The Commission or Administrative Law Judge may also compel testimony to be taken by deposition. Witnesses are to be paid the same fees and mileage that are paid in U.S. courts.

665

77

Upon application to the appropriate district court, such court can require a person to appear, testify or produce evidence as ordered by the Commission or the Administrative Law Judge. Any failure to obey such court order is punishable as contempt.

Section 115. Authorization and Appropriations.

Section 115--authorized appropriations of any moneys in the Treasury not otherwise appropriated that may be necessary to carry out the provisions of this title.

Section 116. Mandatory Health and Safety Training.

Section 116(a)--requires each operator to have a safety

training program which shall be approved by the Secretary, and requires the Secretary, within 180 days of enactment of this Act, to promulgate regulations dealing with the requirements of such training programs, but which require not less than that:

(1) new underground miners are to receive no less than 40 hours of training, including use of the self-rescuer and respiratory devices, hazard recognition, escapeways, walk around training, emergency procedures, basic ventilation and roof control electrical hazards, first aid, and the health and safety aspects of the particular job to which they will be assigned.

(2) new surface miners to receive no less than 24 hours of training to include self-rescue and other respiratory devices, hazard recognition and emergency procedures, electrical hazards, first aid, walk around training, and safety and health hazards of the job to which they will be assigned.

(3) no less than 8 hours of refresher training annually, except that existing miners are to receive this refresher training within 90 days after approval of the operator's safety training program; and

(4) training for any miner who is being reassigned to a new task in the specific safety and health aspects of that task.

Section 116(b)--requires that the training given to miners under this section is to be given during normal working hours, and that miners shall be paid at the normal rate of pay for attending such training, and that if the training is to be given away from the normal work place, miners are to be compensated for the expense attendant to taking such training.

Section 116(c)--requires that upon the completion of each training program the operator shall certify that the miner received that training, and that such certification shall be on a form approved by the Secretary, which form shall conspicuously indicate that false certification of training shall be punishable under section 111(g) and (h) of the Act. The section further requires the operator to maintain at the mine, available for inspection, a copy of this certification, and that the operator shall give a copy of the certificate to each miner upon completion of the training, and when that miner shall leave the operator's employ.

Section 116(d)--authorizes the Secretary to promulgate appropriate safety and health training standards for miners engaged in construction work.

Section 116(e)--requires the Secretary, within 18 days after

the effective date to publish regulations requiring that mine rescue team capability be provided for rescue and recovery work at each underground mine.

666

78

Section 202. Amendments with Respect to Interim Mandatory Health Standards.

Section 202(a)--amends Section 202(e) of the Federal Coal Mine Health and Safety Act of 1969 to provide that references to respirable dust shall mean average concentrations of respirable dust measured with a device approved by the Secretary of Health, Education and Welfare.

Section 202(b)--amends Section 318 of the Federal Coal Mine Health and Safety Act of 1969 by striking subsection (k) thereof.

Section 203--Amendments with respect to interim mandatory safety standards for underground coal mines

Section 203--amends Section 301 of the Federal Coal Mine Health and Safety Act of 1969 by striking subsections (c) and (d) thereof.

Title III--Miscellaneous Provisions

Section 301. Transfer Matters.

Section 301(a)--transfers the functions of the Secretary of the Interior under the Federal Coal Mine Health and Safety Act of 1969 as amended, except in the safety research function and the Federal Metallic and Nonmetallic Mine Safety Act of 1966 to the Secretary of Labor, except those expressly transferred to the Commission by this Act.

Section 301(b) (1)--provides that the mandatory standards relating to mines issued by the Secretary of the Interior under the Federal Metal and Nonmetallic Mine Safety Act of 1966 and standards and regulations under the Federal Coal Mine Health and Safety Act of 1969 which are in effect on the date of enactment of this Act shall remain in effect as mandatory standards applicable to metallic and nonmetallic mines and coal mines respectively under the Federal Mine Safety and Health Act of 1977.

Section 301(b) (2)--provides that within 60 days of enactment of

the Amendments Act of 1976, the Secretary shall establish an advisory committee under section 103 which shall review the advisory standards promulgated under the 1966 Metal Act, and within 180 days recommend to the Secretary which of these standards or any modifications thereof which does not diminish substantially the health and safety of miners shall be promulgated as permanent standards. The Secretary shall publish the recommendations of the Advisory Committee within 60 days, and afford interested persons a period of 25 days to comment. Within 30 days after the close of the comment period, the Secretary shall publish in the Federal Register the standard he shall adopt, as modified as a result of the comments, or if he decides not to publish such standard, his explanation therefore.

Section 301(c)(1)--transfers to the Department of Labor or the Commission, as appropriate, all personnel, property, records, obligations, unexpended balances of appropriations, and commitments which are used primarily with respect to any transferred function under section 301(a). The transfer of personnel pursuant to this paragraph shall be without reduction in classification or compensation for one year after such transfer, except that the Secretary shall have full

667

79

authority to assign personnel during such one-year period in order to efficiently carry out functions transferred to him under this Act.

Section 301(c)(2)--provides that all orders, decisions, determinations, rules, regulations, permits, contracts, certificates, licenses, and privileges (A) which have been issued, made, granted, or allowed to become effective in the exercise of functions which are transferred under this section by any department or agency or any functions of which are transferred by this section and (B) which are in effect when this section takes effect, shall continue in effect according to their term until modified, terminated, superseded, set aside, or repealed by the Secretary, the Commission, any court of competent jurisdiction, or operation of law.

Section 301(c)(3)--provides that the provisions of this section shall not affect any proceedings pending at the time this section takes effect before any department or agency, functions of which are transferred by this section; except that such proceedings as they relate to transferred functions shall be continued before the Secretary or the Commission. Orders shall be issued in such proceedings, appeals shall be taken therefrom, and payments shall

be made pursuant to such orders, as if this section had not been enacted, and orders issued in any such proceedings shall continue in effect until modified, terminated, superseded, or repealed by the Secretary, the Commission, a court of competent jurisdiction, or operation of law.

Section 301(c)(4)--provides that the provisions of this section shall not affect suits commenced prior to this section's effective date and in all such suits proceedings shall be had, appeals taken, and judgments rendered, as if this section had not been enacted; except that if before this section's effective date, any department or agency (or officer thereof in his official capacity) is a party to a suit involving functions transferred to the Secretary, then such suit shall be continued by the Secretary. No cause of action, and no suit action, or other proceeding, by or against any department or agency (or officer thereof in his official capacity), functions of which are transferred by this section, shall abate by reason of this section's enactment. Cause of action, suits, actions, or other proceedings may be asserted by or against the United States or the Secretary as appropriate and in any litigation pending when this section takes effect, the court may at any time, on its own motion or that of any party, enter an order which will give effect to the provisions of this paragraph.

Section 301(d)--provides that for purposes of this section, the term "function" includes power and duty, and the transfer of a function of an agency or the head of a department shall also be a transfer of all functions which are exercised by any office or officer of such agency or department.

Section 301(e)--authorizes the Director of the Office of Management and Budget in consultation with the Secretary and the Secretary of the Interior to make determinations as necessary regarding the disposition of assets, personal positions, appropriations and the like arising from the transfer of responsibilities between the two Departments.

Section 302. Mining Enforcement and Safety Administration.

Section 302(a)--establishes in the Labor Department a Mining Enforcement and Safety Administration to be headed by an Assistant Secretary of Labor for Mine Safety and Health appointed by the

668

80

President, with the Senate's advice and consent. The Secretary

is authorized and directed to carry out his functions under the Act through the Administration except as otherwise provided.

Section 302(b)--amends 5 United States Code 5315 by adding "[109] Assistant Secretary of Labor for Mine Safety and Health."

Section 302(c)(1)--amends 5 U.S.C. 5314 by adding "(64) Chairman, Federal Mine Safety and Health Review Commission."

Section 302(c)(2)--amends 5 U.S.C. 5315 by adding "(109 Members, Federal Mine Safety and Health Review Commission."

Section 303. Amendments with Respect to Mine Safety and Health Administration.

Section 303(a)(1) applies the research provisions of section 501(a) of the Coal Act to all mines covered by this Act; and authorizes the Secretary of the Interior to conduct safety research. The Secretary of Health, Education and Welfare to conduct health research.

Section 303(a)(2)--further amends Section 501(a) by establishing authority for the Secretaries of the Interior and Health, Education and Welfare to, upon the specific written request of an operator or authorized representative of miners, determine whether any substance or physical agent found in a mine has potentially harmful effects, and to so inform the operators and miners of such findings as soon as possible.

Section 303(a)(3)--amends section 501(b) such that research activities relating to mine health will be carried out by the Secretary of Health, Education, and Welfare through the National Institute of Occupational Safety and Health, and that the research activities relating to safety are extended to all mines now covered by this Act, is to be performed by the Secretary of the Interior in coordination with the Secretary.

Section 303(a)(4)--details the authorities of the Secretaries of the Interior and Health, Education, and Welfare to conduct research.

Section 303(a)(5)--extends to all mines covered by this Act the Secretary of Health, Education, and Welfare's authorization under section 501(d) to conduct studies and research involving the protection of life and prevention of diseases relating to certain nonminers who work with or around mine products.

Section 303(a)(6)--increases the safety research appropriation authorization to reflect the increased scope of research activity

under Section 501.

Section 303(a)(7)--amends Section 501 by requiring the Secretary to compile accurate statistics on work injuries and illnesses occurring in mines subject to the Federal Mine Safety and Health Act of 1976.

Section 303(b) extends the training and education provisions of section 502 to all mines now covered by the Act.

Section 303(c)(1)--amends section 503(a) to authorize the Secretary in coordination with the Secretary of Health, Education, and Welfare, to make grants to any State in which mining takes place.

Section 303(c)(2)--applies to the criteria for approval of State grant applications to all mining states.

Section 303(d)(1) expands the exchange of State and Federal inspection reports provided for in section 503(f) to include inspection reports of all mines covered by this Act.

669

81

Section 303(d)(2)--extends to any mining State the 80 percent limit on State grants in any fiscal year provided for in section 503(g).

Section 303(d)(3)--increases the appropriation authorization for such state grants to reflect the expanded State eligibility for such grants.

Section 303(e)(1) revises the qualifications for mine inspectors under section 505 to include practical experience in mining in lieu of "practical experience in the mining of coal."

Section 303(e)(2)--amends Section 505 by requiring that mine inspectors, to the extent feasible, be qualified with at least 5 years practical mining experience with consideration in assignments given to previous experience in the particular type of mine to be inspected.

Section 303(f) amends section 506(b) such that any State law or regulation providing for health and safety standards applicable to any mine now covered by this Act and that (1) are more stringent than Federal law, or (2) apply to any area not covered by Federal law, shall not be held to be in conflict with this Act.

Section 303(g)(1) amends section 511(a) such that the Secretary's annual report shall cover health and safety relating to all mines now covered by this Act.

Section 303(g)(2) amends section 511(b) such that the annual report of the Secretary of Health Education, and Welfare shall cover health matters relating to all mines covered by this Act.

Section 303(h)--amends Section 502 by adding the following new section:

(c)(1) The National Mine Health and Safety Academy is to be maintained as an agency of the Interior Department. The Academy is responsible for mine safety and health inspectors' training and technical support personnel training. The Academy is authorized to enter into cooperative educational and training agreements.

(c)(2) provides that the Academy shall use the facilities and personnel of the Interior Department and other personnel as mutually agreed upon by the Secretaries of Labor and Interior. Officers and employees of the Academy may be appointed by the Secretary of Interior.

CHANGES IN EXISTING LAW

In compliance with subsection (4) or rule XXIX of the Standing Rules of the Senate, changes in existing law made by sections 1 through 9 and titles I through VI of the bill, as reported, are shown as follows (existing law proposed to be omitted is enclosed in black brackets; new matter printed in italic).

[The remainder of the Senate Report is not included in this document]

U.S. Department of Labor

Office of Inspector General—Office of Audit

MINE SAFETY AND HEALTH ADMINISTRATION



PATTERN OF SIGNIFICANT AND SUBSTANTIAL VIOLATION RATE EXTENDED ANALYSIS

AB73-BKG-27

Date Issued: December 15, 2010
Report Number: 05-11-002-06-001